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general notes

- Data in this report were collected by the Bureau of the Census for the National Science Foundation (NSF) in the annual Survey of Industrial Research and Development and cover the periods 1956-80 for funding data and January 1957-January 1981 for personnel data.
- The industry survey does not cover trade associations. Although their primary mission is to serve industry, trade associations are established as nonprofit organizations and are covered in the NSF survey of independent nonprofit institutions. R&D expenditures of trade associations are estimated at less than 1 percent of the industry R&D total.
- Complete technical notes are contained in section A. Additional questions regarding these survey findings should be addressed to Melissa Pollak or Mary Burke, Industry Studies Group, Division of Science Resources Studies, National Science Foundation, Washington, D.C. 20550 (202) 634-4648.

section a

technical notes

scope of study

The National Science Foundation (NSF) sponsored its first survey of industrial research and development in 1953. Since then the scope of the survey has gradually been expanded and refined in response to an increasing need for more detailed information on the Nation's R&D effort.

The 1980 industry survey is the 24th in the annual series sponsored by NSF and conducted by the Bureau of the Census, U.S. Department of Commerce. NSF also sponsored two industry surveys covering the 1953-56 period, which were conducted by the Bureau of Labor Statistics (BLS), U.S. Department of Labor.¹ Data obtained in the BLS survey are not directly comparable with the Census figures for 1957-80 because of methodological and other differences in the surveys conducted by the two agencies. In addition, the Census surveys collect data on the R&D activities of federally funded research and development centers (FFRDC's) operated by business firms, whereas the earlier BLS surveys did not. (FFRDC's are organizations administered by industrial, educational, or other institutions on a nonprofit basis; they conduct R&D activities almost exclusively for the use of the Federal Government. R&D expenditures of industry-administered FFRDC's, included in this

survey as part of the Federal R&D data, are listed under the classifications of the administering firms. Total R&D expenditures and selected personnel data for FFRDC's are shown in table B-13.) To account for the R&D performance of these research centers in 1956, Census adjusted data for that year (collected in the 1957 survey) to provide comparable trend data for 1956 and earlier years.

Data on scientific personnel are not directly comparable with data in earlier surveys conducted by BLS. The Census Bureau uses the company, defined to include all establishments under common ownership or control, as the basic reporting unit for these surveys of industrial research and development. Surveys of scientific and technical personnel conducted by BLS, in contrast, were on an establishment-reporting-unit basis. Further, the Census surveys obtain data on the number of R&D scientists and engineers on a full-time-equivalent (FTE) basis, unlike the BLS surveys in which data were provided in terms of scientists and engineers primarily employed in research and development. Other variations in the two sets of data may be the result of different offices in the same company preparing the estimates, or the varying response rates of the two surveys.

The statistics presented in this report are subject to response and concept errors caused by differences between survey and industry concepts, definitions of R&D activities, and by variations in company accounting procedures. Consequently, the accuracy of the data provided by respondents is subject to some variation.

The quality of the data has improved substantially since the first industry survey in 1953, mainly as a result of more accurate and sophisticated accounting procedures adopted by respondents. In addition, NSF and Census have endeavored to reduce response and concept errors arising from difficulties in interpreting or applying survey definitions.

NSF has been aware of the increased reporting burden placed on industry from all sources in recent years. In an effort to alleviate this burden the Foundation changed the content of the industrial survey. The detailed questionnaire (which has been in use with slight modifications since the beginning of the survey) is now mailed only biennially; an abbreviated form containing only the most crucial data elements is sent to survey respondents in the intervening years. The shortened survey form was used for the first time to collect industrial R&D data for 1978.

Because not all data elements were collected for 1980, many of the tables were not published in this volume. The main tables affected are those which give detailed breakdowns of R&D expenditures for basic research, applied research, and development by industry and by product field. Some detailed data on energy and pollution abatement R&D activities are also deleted, as well as tables showing company-financed research and development contracted to outside organizations, Federal funds by agency, and R&D expenditures by geographic area. The full questionnaire will be mailed for the 1981 survey, and all the tables will reappear in the 1981 publication.

¹National Science Foundation, *Science and Engineering in American Industry, Final Report on a 1953-54 Survey* (NSF 56-16) and *Science and Engineering in American Industry, 1956* (NSF 59-50) [Washington, D.C.: Supt. of Documents, U.S. Government Printing Office, 1956 and 1960].

survey definitions²

Research and development—Basic and applied research in the sciences and engineering and the design and development of prototypes and processes. This definition excludes quality control, routine product testing, market research, sales promotion, sales service, research in the social sciences or psychology, and other non-technological activities or technical services.

Basic research—Original investigations for the advancement of scientific knowledge not having specific commercial objectives, although such investigations may be in fields of present or potential interest to the reporting company.

Applied research—Investigations directed to the discovery of new scientific knowledge having specific commercial objectives with respect to products or processes. This definition differs from that of basic research chiefly in terms of the objectives of the reporting company.

Development—Technical activities of a nonroutine nature concerned with translating research findings or other scientific knowledge into products or processes. Does not include routine technical services to customers or other activities excluded from the above definition of research and development.

Funds for research and development—Operating expenses incurred in the conduct of research and development in a company's own laboratories or other company-owned or -operated facilities. Includes wages and salaries, materials and supplies consumed, property and other taxes, maintenance and repairs, depreciation, and an appropriate share of overhead, but excludes capital expenditures. All funds for R&D performance are expressed in this publication in current dollars rather than in constant dollars.

Federally financed research and development—Work done by the company on Federal R&D contracts or subcontracts

and R&D portions of procurement contracts and subcontracts.

Company-financed research and development—Cost of the company-sponsored research and development performed within the company. Does not include company-financed research and development contracted to outside organizations, such as research institutions, universities and colleges, or other nonprofit organizations.

R&D scientists and engineers—The January total of those engaged in research and development full time, and the full-time equivalent of those working part time in research and development. Scientists and engineers are defined as persons engaged in scientific or engineering work at a level which requires a knowledge of physical, life, engineering, or mathematical sciences equivalent at least to that acquired through completion of a 4-year college course with a major in one of those fields.

Employment—Total number of persons employed by the company in all activities during the pay period which includes the 12th of March. These data are not completely comparable with employment of R&D scientists and engineers data which are collected as of January.

Net sales and receipts—Recorded dollar values for goods sold or services rendered by a company to customers outside the company, including the Federal Government, less such items as returns, allowances, freight charges, and excise taxes. Excludes domestic intracompany transfers as well as sales by foreign subsidiaries, but includes transfers to foreign subsidiaries. For companies classified in communication equipment (SIC 360), manufacturing sales are included and revenues from their telecommunication activities are excluded. Net sales and receipts figures are expressed in current rather than constant dollars. All tables which include net sales figures, with the exception of table B-2, do not include data for nonmanufacturing companies.

Geographic area covered—Includes only those operations located in the 50 States and the District of Columbia.³

explanation of tabular data

Industry classification—Industries and industry groups shown separately in statistical tables are classified according to their Standard Industrial Classification Manual⁴ codes as follows:

- Food and kindred products (20)
- Textiles and apparel (22, 23)
- Lumber, wood products, and furniture (24, 25)
- Paper and allied products (26)
- Chemicals and allied products (28)
- Industrial chemicals (281-82, 286)⁵
 - Drugs and medicines (283)
 - Other chemicals (284-85, 287-89)⁵
- Petroleum refining and related industries (29)⁶
- Rubber products (30)
- Stone, clay, and glass products (32)
- Primary metals (33)
 - Ferrous metals and products (331-32, 3398-99)
 - Nonferrous metals and products (333-36)
- Fabricated metal products (34)
- Machinery (35)
 - Office, computing, and accounting machines (357)
 - Other machinery, except electrical (351-56, 358-59)
- Electrical equipment (36)⁶
 - Radio and TV receiving equipment (365)
 - Communication equipment (366)
 - Electronic components (367)
 - Other electrical equipment (361-64, 369)
- Motor vehicles and motor vehicles equipment (371)
- Other transportation equipment (373-75, 379)
- Aircraft and missiles (372, 376)⁷

⁴Executive Office of the President, Office of Management and Budget, *Standard Industrial Classification Manual*, 1972 (Washington, D.C.: Supt. of Documents, U.S. Government Printing Office.) Industry group code numbers are shown in parentheses.

⁵The classification "Industrial Chemicals" was revised in 1978 to include SIC Group 286, Industrial Organic Chemicals, which had previously been reported under "other chemicals." All current and historical tables have been revised accordingly.

⁶Beginning with the 1978 survey, oil and gas extraction (13) is no longer being grouped with petroleum refining (29), nor is communication (48) being grouped with electrical equipment (36). Instead, these SIC groups are included in the nonmanufacturing classification so that the delineation between manufacturing and nonmanufacturing industries is more consistent. This change has almost no effect on the levels of the data.

⁷Companies primarily engaged in the manufacture of ordnance and accessories, including complete guided missiles, are grouped with companies primarily engaged in the manufacture of aircraft and parts because of close similarity of R&D activities carried out by major companies in the two industries.

²For more detailed information on definitions, as well as the instructions for individual items covered in the survey questionnaire, see section C.

³For purposes of comparison, company-sponsored research and development by foreign affiliates of U.S. domestic companies performed outside the United States is reported in table B-8 but excluded from all other tables.

Professional and scientific instruments (38)
 Scientific and mechanical measuring instruments (381-82)
 Optical, surgical, photographic, and other instruments (383-87)
 Other manufacturing industries—tobacco manufactures (21), printing and publishing (27), leather products (31), and miscellaneous manufacturing industries (39)
 Nonmanufacturing industries—agriculture, forestry, and fisheries (07-09), mining and extraction (10-14), contract construction (15-17), transportation, communications, and other public utilities (41-49), wholesale and retail trade (50-59), finance, insurance, and real estate (60-67), and selected service industries (729-807-891)

Company size-class—The size of a company as determined by the total number of its employees. The five company size-classes used in this report are: less than 1,000 employees; 1,000 to 4,999 employees; 5,000 to 9,999 employees; 10,000 to 24,999 employees; and 25,000 or more employees.

Classification of reporting units—The company or corporate family which includes all establishments under common ownership or control is the basic reporting unit. Each company was similarly classified into a single size-category on the basis of its total employment.

Cost per R&D scientist or engineer—The number of R&D scientists and engineers used to estimate the cost per R&D scientist or engineer for 1957-80 is the arithmetic mean of the numbers of R&D scientists and engineers reported in each industry for January in two consecutive years. This number is then divided into the total R&D expenditures of each industry. For example, the mean of the numbers of R&D scientists and engineers in January 1980 and January 1981 is divided into total 1980 R&D expenditures for a total cost per scientist or engineer in 1980.

Nonavailability of certain statistics—Tables in section B use the term, "not separately available but are included in total," indicating that statistics are withheld for not meeting publication standards for reasons such as: extremely high associated sampling error of estimate; high rate of imputation (over 50 percent) because of failure of companies to report; possible disclosure of data on an individual company; or data inconsistent for inclusion in a time series. In some instances, withheld data can be derived by subtraction from higher level totals. Where this is possible, the data user should be aware that the derived numbers are statistically unreliable.

In no instance, however, can any data be derived which would disclose the operations of an individual company.

Questionable data—Data where over 50 percent of the total has been estimated are not published. Users should consult table A-1 for imputation rates for specific items.

Method of computation—Detailed statistics in the tables may not add to totals or subtotals because of rounding. Also, percentages were calculated on the basis of thousands of dollars and may differ from those based on the rounded figures shown.

methodology of survey⁸

The sample used for the 1980 Survey of Industrial Research and Development represented all manufacturing industries and those nonmanufacturing industries known, on the basis of earlier, more detailed samples, to conduct or to finance research and development. The sampling unit for the survey was the company, defined as a business organization consisting of one or more establishments under common ownership or control. A new panel for the R&D survey is selected approximately every five years. The latest panel was selected for the 1976 survey, the first since the 1971 survey. Approximately 11,500 manufacturing and nonmanufacturing companies are included in the current sample, which consists of about 4,500 certainty companies (those with 100-percent chance of inclusion in the panel) and about 7,000 noncertainty companies.

The basic tool for the survey is Form RD-1, which seeks detailed R&D information from respondents. Companies in the new panel which had received an RD-1 form in the old panel (1971-75) once again received an RD-1 form in 1976 (about 1,100 companies). The remaining certainty and noncertainty companies in the new panel received an RD-2 survey form in 1976. Form RD-2 is an abbreviated version of RD-1 and is only mailed to companies in the year in which a new sample is drawn. The purpose of Form RD-2 is to canvass smaller R&D performers with a minimum of reporting burden. Once the RD-2 forms from

the survey respondents in 1976 were received and tabulated, they were reviewed for size. Those RD-2 companies which reported R&D expenditures of \$500,000 or greater were converted to Form RD-1 reporters and were included with other RD-1 companies in the 1977-80 surveys. There were about 450 such companies. The remaining RD-2 companies were not mailed another form. Census estimated their data based upon their 1976 reports.

All manufacturing and selected nonmanufacturing companies (in SIC's 49, 7301-02, 7309, and 8011) with 1,000 or more employees were included in the sample with certainty. Manufacturing and selected nonmanufacturing companies with fewer than 1,000 employees were sampled at rates depending upon their industry and employment size (table A-2). The source of this sample was the 1974 Standard Statistical Establishment List (SSEL). For 1976, the SSEL was used for the first time as a source for the R&D sample. For other nonmanufacturing industries, the sample was based on the 1966 records of the Social Security Administration.

Each year the Census Bureau reviews the annual lists of R&D contractors published by the Department of Defense and the National Aeronautics and Space Administration (NASA) to ensure that the large contractors are included in the sample. For the 1980 survey, the R&D-performing manufacturing companies from the 50 largest NASA contractors were included in the reporting panel with certainty.

The particular sample selected is one of a large number of samples of the same type and size that, by chance, might have been selected. Estimates from each of the different samples would differ somewhat from each other, and from the results of a complete canvass conducted under essentially the same conditions as the survey. This variation among the possible estimates is defined by the sampling error, measured in standard error units. The complete canvass total would be included in the range—

1. From one standard error below to one standard error above the derived estimate for about two-thirds of all possible samples.
2. From two standard errors below to two standard errors above the derived estimate for about 95 percent of all possible samples.

⁸This section was prepared in the Industry Division of the Bureau of the Census, the collecting and compiling agent for NSF in this survey.

Table A-1. Imputation rates for selected items on the R&D survey by industry: 1980

Industry	SIC Code	Sales ¹	Employment ¹	Scientists and engineers ¹	R&D expenditures					
					Total ¹	Company ¹	Federal ¹	Energy	Pollution abatement	Foreign
Total.....		7.3	6.5	26.6	6.1	5.6	7.1	13.5	33.3	8.3
Food and kindred products.....	20	7.1	6.9	33.0	2.3	2.3	-	-	-	5.1
Textiles and apparel.....	22,23	4.4	4.2	12.2	7.8	7.9	-	8.6	1.1	-
Lumber, wood products, and furniture.....	24,25	1.9	.8	26.3	.8	.8	-	-	1.8	-
Paper and allied products.....	26	1.4	1.5	25.4	.8	.8	-	21.4	61.7	6.2
Chemicals and allied products.....	28	.1	1.1	24.7	1.1	1.2	-	4.0	3.0	14.4
Industrial chemicals.....	281-82,286	.2	.2	16.0	.9	1.1	-	3.3	2.8	4.9
Drugs and medicines.....	283	1.1	1.2	35.7	.2	.2	-	1.2	7.4	21.4
Other chemicals.....	284-85,287-89	2.5	2.8	20.5	3.8	3.9	-	17.1	3.4	2.3
Petroleum refining and related industries.....	29	15.2	11.8	22.7	1.2	1.1	1.2	17.5	8.3	1.2
Rubber products.....	30	1	.9	67.4	3.6	4.7	-	9.8	34.9	72.7
Stone, clay, and glass products.....	32	.3	8.4	52.9	31.0	25.8	98.3	35.5	14.7	27.1
Primary metals.....	33	1.4	1.4	24.7	6.1	6.4	-	.5	4.3	24.1
Ferrous metals and products.....	331-32,3398-99	1.2	1.3	29.0	7.1	7.2	-	.1	.3	-
Nonferrous metals and products.....	333-36	10.4	2.7	21.7	5.2	5.6	-	.7	7.4	30.4
Fabricated metal products.....	34	9.0	8.4	30.5	11.2	12.3	-	.9	10.5	80.3
Machinery.....	35	3.3	4.8	26.6	4.4	5.1	.1	17.6	2.3	3.1
Office, computing, and accounting machines.....	357	5.3	8.0	31.0	4.6	5.7	.1	-	-	-
Other machinery, except electrical.....	351-36,358-59	2.4	2.9	16.2	2.2	2.2	4.9	21.1	2.3	4.3
Electrical equipment.....	36	3.7	4.2	32.9	2.9	4.6	.6	.9	4.0	3.2
Radio and TV receiving equipment... communication equipment.....	365	10.9	16.2	11.8	11.5	11.5	-	-	-	62.4
Electronic components.....	366	3.9	4.3	25.1	1.0	2.1	-	.2	-	.2
Other electrical equipment.....	367	11.6	12.3	52.7	13.1	15.7	1.3	15.1	30.1	25.7
Other electrical equipment.....	361-64,369	.6	.7	33.7	.7	1.5	-	.8	4.0	30.9
Motor vehicles and motor vehicles equipment.....	371	4.3	4.3	5.5	.3	.4	-	28.7	58.6	.3
Other transportation equipment.....	373-75,379	16.4	17.9	17.1	15.3	25.2	11.6	8.0	-	-
Aircraft and missiles.....	372,376	1.0	4.5	16.7	5.4	5.3	5.4	20.4	13.8	28.5
Professional and scientific instruments.....	38	3.2	3.8	43.0	2.9	3.2	.8	17.4	2.8	10.4
Scientific and mechanical measuring instruments.....	381-82	4.2	3.8	46.0	4.3	4.9	.2	18.9	8.4	63.2
Optical, surgical, photographic, and other equipment.....	383-87	2.7	3.8	40.9	2.3	2.3	1.2	14.0	-	1.1
Other manufacturing industries.....	21,27,31,39	12.9	13.9	35.3	7.8	9.0	8.9	6.4	19.5	8.0
Nonmanufacturing industries.....	07-17,41-67, 737,739,807,891	7.2	9.4	27.5	5.0	9.3	13.7	4.3	4.8	46.5

- Represents no imputation.

¹ These items calculated from Form RD-1 (detailed form mailed to large corporations conducting research and development) and from Form RD-2 (abbreviated version of RD-1 form mailed to smaller R&D performers). All other items calculated from Form RD-1 only; RD-2 respondents were not asked these questions.

3 From three standard errors below to three standard errors above the derived estimate, almost always.

An inference that the comparable complete canvass total would be within the indicated ranges would be correct in approximately the relative frequencies shown. Those proportions, therefore, may be interpreted as defining the confidence that the estimates from a particular sample would differ from complete coverage results by as much as one, two, or three standard errors, respectively.

For example, suppose an estimated total is shown as 400 with an associated relative standard error of 2 percent. There is then approximately 67-percent confidence that the interval 392 to 408 includes the complete canvass total, about 95-percent confidence that the interval 384 to 416 includes the complete canvass total, and almost cer-

tain confidence that the interval 376 to 424 includes the complete canvass total.

In addition to the sampling errors measured by the standard error, the estimates are subject to errors in response, coding, processing, and imputation for nonresponse. These nonsampling errors would also occur if a complete canvass were to be conducted under the same conditions as the survey (table A-3).

The forms for the survey were mailed in March 1981, and nonrespondents received followups by mail. Since total R&D performance funds, total Federal R&D funds, total net sales, and total employment are included in the Census Bureau's mandatory statistical program, the few companies that did not reply to Form RD-1 for 1980 were mailed the Census Form MA-121, which collects these mandatory items.

In the absence of respondent-distributed data, Census has estimated data for items as required in accordance with past performance and industry averages. Table A-1 shows estimation rates for most items on the R&D survey form.

comparability of data

In the surveys of industrial research and development there is substantial comparability over any 2-year period. Before mailing the new survey forms each year, Census enters on each one the previous year's figures as reported by the respondent. The respondent is asked to adjust the data for the previous year as necessary to make it comparable to those data being reported for the current year. Such adjustments are

Table A-2. Sampling ratios used in the selection of manufacturing and nonmanufacturing companies included in the survey of industrial research and development by industry and size of company: 1980

Industry	SIC code ¹	Companies with total employment of—			
		1-99	100-499	500-999	1000 +
Food and kindred products	20	008	050	750	1 000
Textiles and apparel	22-23	006	031	1 000	1 000
Lumber, wood products, and furniture	24-25	010	100	750	1 000
Paper and allied products	26	006	062	1 000	1 000
Chemicals and allied products					
Industrial chemicals	281-82.286	111	1 000	1 000	1 000
Drugs and medicines	283	333	1 000	1 000	1 000
Other chemicals	284-85.287-89	014	666	1 000	1 000
Petroleum refining and related industries	29	062	1 000	1 000	1 000
Rubber products	30	010	200	1 000	1 000
Stone, clay, and glass products	32	008	200	1 000	1 000
Primary metals					
Ferrous metals and products	331-32.3398-99	008	142	1 000	1 000
Nonferrous metals and products	333-36	006	625	1 000	1 000
Fabricated metal products	34	010	200	1 000	1 000
Machinery	35	006	125	1 000	1 000
Office, computing, and accounting machines	357	006	125	1 000	1 000
Electrical equipment					
Radio and TV receiving equipment	365	083	1 000	1 000	1 000
Electronic components	367	031	1 000	1 000	1 000
Communication equipment	366	031	1 000	1 000	1 000
Other electrical equipment	361-64.369	062	333	1 000	1 000
Motor vehicles and motor vehicles equipment	371	018	500	1 000	1 000
Other transportation equipment	373-75.379	029	666	1 000	1 000
Aircraft and missiles	372.376	111	1 000	1 000	1 000
Professional and scientific instruments					
Scientific and mechanical measuring instruments	381-82	200	1 000	1 000	1 000
Optical, surgical, photographic, and other instruments	383-87	062	1 000	1 000	1 000
Other manufacturing industries	21.27.31.39	006	062	1 000	1 000
Nonmanufacturing industries	07-17.44.50.53. 60.63.737.807	(²)	(²)	(²)	(²)
	49.7391-92. 7399.8911	1-49 50-99 1 010 1 500	500	1 000	1 000

¹ Executive Office of the President, Office of Management and Budget, *Standard Industrial Classification Manual* 1972. Washington, D.C. 20402. Supt. of Documents, U.S. Government Printing Office.

² Companies in these SIC codes were not sampled, but were hand selected from the previous mailing panel.

³ Sampling in these cells was a 2-stage process. An initial rate of .500 was used for the entire cells. The selected cases with total employment less than 50 were then subsampled at a 1/50 rate. Those with total employment greater than or equal to 50 were not subsampled.

made to reflect, for example, changes in reporting concepts or changes in company structure such as mergers or acquisitions. To maintain some measure of consistency, the employment-size classification of any company affected by such changes is adjusted so that the data from the company

is tabulated in the same employment-size category for two consecutive years.

Some measure of the degree of change reflecting these types of adjustments in contrast to an actual change in R&D activity can be gained by comparing figures for the same year reported in two succeeding sur-

vey publications, e.g., 1979 R&D statistics in the final report of the 1979 survey and the revised 1979 R&D statistics in the final report of the 1980 survey. The totals for broad classifications are likely to be very close in the two reports; larger differences are noticeable in the finer detail. The results underscore the point that the measures are approximate and indicative rather than precise.

industry codes for 1967-80⁹

The industry codes appearing in the tables are based on the 1972 Standard Industrial Classification (SIC) Manual. The SIC code for individual companies for 1967-74 (which were utilized in the publications for those years) were originally determined by data reported in the 1967 Economic Censuses. Between 1967 and 1974 the SIC code for a company on the R&D survey generally remained fixed and reflected that company's principal activity as of 1967. Under certain circumstances, however, such as the merger of two or more companies, the acquisition of one company by another, or the formation of conglomerates,⁹ the 1967 SIC code for a company could have changed. The Bureau of the Census would not have been aware of any SIC code change for a company until the 1976 new sample was drawn based upon the 1974 SSEL file. (See above description of the new sample.) When the new sample was selected, Census examined the industry codes of companies in both the old and new panels for possible change. For larger R&D companies which switched industry codes between panels, the historical R&D tables (i.e., 1968-74) have been adjusted to reflect the change in company activities. As it was not generally known when a company changed its industrial activities, the data were adjusted in the following fashion: For companies whose

⁹For a discussion of industry codes for 1966 and earlier years, see National Science Foundation, *Research and Development in Industry, 1975. Funds, 1975, Scientists & Engineers, January 1976* [NSF 77-324] and *Research and Development in Industry, 1970. Funds, 1970, Scientists & Engineers, January 1971* [NSF 72-309] (Washington, D.C.: Supt. of Documents, U.S. Government Printing Office, 1978 and 1972.)

Table A-3. Standard error of estimate (percentage) of funds for R&D-performing companies by industry: 1980

Industry	SIC code	Standard error ¹
Total		(²)
Food and kindred products	20	3
Textiles and apparel	22,23	6
Lumber, wood products, and furniture	24,25	3
Paper and allied products	26	3
Chemicals and allied products	28	(²)
Industrial chemicals	281-82,286	(²)
Drugs and medicines	283	(²)
Other chemicals	284-85,287-89	2
Petroleum refining and related industries	29	(²)
Rubber products	30	1
Stone, clay, and glass products	32	3
Primary metals	33	2
Ferrous metals and products	331-32,3398-99	(²)
Nonferrous metals and products	333-36	3
Fabricated metal products	34	2
Machinery	35	1
Office, computing, and accounting machines	357	1
Electrical equipment	36	(²)
Radio and TV receiving equipment	365	(²)
Communication equipment	366	(²)
Electronic components	367	(²)
Other electrical equipment	361-64,369	(²)
Motor vehicles and motor vehicles equipment	371	(²)
Other transportation equipment	373-75,379	1
Aircraft and missiles	372,376	(²)
Professional and scientific instruments	38	1
Scientific and mechanical measuring instruments	381-82	2
Optical, surgical, photographic, and other instruments	383-87	(²)
Other manufacturing industries	21,27,31,39	2
Nonmanufacturing industries	07-17,41-67,737,739,807,891	4

¹A description of the standard error of estimate is given in section A under "Methodology of Survey." The percentage (or relative) standard errors in this table may be converted to standard errors of estimate by multiplying the percentage shown by the associated estimate. For example, the relative standard error of estimate for R&D performance for all company size groups in the food and kindred products industry (SIC 20) is shown as 3 percent, and the associated total R&D estimate for this industry is shown as \$517 million in table B-3, "funds for research and development by industry and size of company: 1980." The standard error of estimate, then, is .03 times 517 or 15.5.

²Less than 0.5 percent.

SOURCE: National Science Foundation.

industry codes changed between 1967 and 1974, the industry total for each of the years affected (1968 through 1974) were estimated to have changed at a constant rate of 14.3 percent per year. The data for the industry in which the company was classified in 1967 were thus deflated by 14.3 percent per year for each of the years 1968-74 (e.g., 14.3 percent subtracted in 1968, 28.6 percent in 1969, 42.9 in 1970, etc.). Similarly,

the data for the industry in which the company was classified in 1974 were inflated by 14.3 percent per year for each of the years 1968-74. The industry code assigned to a company for 1974 is also used to classify that company's activities for the years 1975-80.

The following measures were adjusted in this manner: Number of scientists and engineers; funds for research and devel-

opment—total, Federal, and company; net sales; cost per R&D scientist or engineer; and basic research expenditures. Basic research data are not printed in this 1980 publication but will reappear in the 1981 report. Historical data for the other categories appear in selected tables of this publication. (See tables B-3, B-6, B-10, B-19, B-36, and B-37.) No adjustments were made in data for other measures.

section b

statistical tables

In all tables of this report

- Details may not add to totals because of rounding.
- Percentages were calculated on the basis of thousands of dollars and may differ from those based on the rounded figures shown.
- Percentage changes are increases unless otherwise indicated.

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SOME DATA MAY HAVE SIGNIFICANT IMPUTATION RATES. SEE TECHNICAL NOTES FOR DETAILS.

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Table B-1. Trends in funds for industrial research and development by source: 1956-80

[Dollars in millions]

Year	Total R&D		Federal		Company ¹	
	Amount	Percent change from previous year	Amount	Percent of total	Amount	Percent of total
1956.....	\$6,605	42	\$3,328	50	\$3,277	50
1957.....	7,731	17	4,335	56	3,396	44
1958.....	8,389	9	4,759	57	3,630	43
1959.....	9,618	15	5,635	59	3,983	41
1960.....	10,509	9	6,081	58	4,428	42
1961 ²	10,908	4	6,240	57	4,668	43
1962.....	11,464	5	6,434	56	5,029	44
1963.....	12,630	10	7,270	58	5,360	42
1964.....	13,512	7	7,720	57	5,792	43
1965.....	14,185	5	7,740	55	6,445	45
1966.....	15,548	10	8,332	54	7,216	46
1967.....	16,385	5	8,365	51	8,020	49
1968.....	17,429	6	8,560	49	8,869	51
1969.....	18,308	5	8,451	46	9,857	54
1970.....	18,067	-1	7,779	43	10,288	57
1971.....	18,320	1	7,666	42	10,654	58
1972.....	19,552	7	8,017	41	11,535	59
1973.....	21,249	9	8,145	38	13,104	62
1974.....	22,887	8	8,220	36	14,667	64
1975.....	24,187	6	8,605	36	15,582	64
1976.....	26,997	12	9,561	35	17,436	65
1977.....	29,928	11	10,521	35	19,407	65
1978.....	33,365	11	11,209	34	22,156	66
1979.....	38,147	14	12,492	33	25,655	67
1980.....	43,879	15	13,939	32	29,940	68

¹Company funds include all funds for industrial R&D work performed within company facilities except funds provided by the Federal Government. Excluded are company-financed research and development contracted to outside organizations such as research institutions, universities and colleges, or other nonprofit organizations.

²Funds by source estimated by the National Science Foundation.

SOURCE: National Science Foundation.

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Table B-2. Selected data for companies performing research and development by industry: 1979-80

(Dollars in millions)

Industry ¹	SIC Code	R&D Funds						Net Sales		R&D scientists/ engineers		Total employment (Thousands)	
		Total		Federal		Company		1979	1980	January		1979	1980
		1979	1980	19 9	1980	1979	1980			1980	1981		
Total.....		\$38,147	\$43,879	\$12,492	\$13,939	\$25,655	\$29,940	\$1,285,723	\$1,439,294	446,600	470,200	15,549	13,663
Food and kindred products.....	20	459	517	(²)	(²)	(²)	(²)	110,103	125,115	7,200	7,400	958	973
Tobacco manufactures.....	21	89	141	4	27	85	114	21,512	24,275	1,500	1,600	235	235
Textile mill products.....	22	73	83	(²)	(²)	(²)	(²)	19,960	20,810	1,300	1,300	464	458
Apparel.....	23	20	19	(²)	(²)	(²)	(²)	5,093	6,075	500	400	147	160
Lumber and wood products, except furniture.....	24	87	97	0	0	87	97	15,498	15,612	1,100	1,100	215	208
Furniture and fixtures.....	25	64	68	0	0	64	68	6,076	6,203	1,100	1,200	121	120
Paper and allied products.....	26	454	508	(²)	(²)	(²)	(²)	45,708	48,289	7,500	8,200	528	532
Printing, publishing, and allied industries.....	27	73	89	(²)	0	(²)	(²)	11,448	12,866	1,200	1,300	236	243
Chemicals and allied products.....	28	4,033	4,608	378	407	3,655	4,201	118,094	130,129	50,000	52,800	1,224	1,260
Petroleum refining and related industries.....	29	1,275	1,565	155	151	1,120	1,414	188,434	260,103	11,000	13,400	529	583
Rubber products.....	30	571	646	(²)	(²)	(²)	(²)	30,069	29,546	(²)	(²)	445	421
Leather and leather products.....	31	14	18	0	0	14	18	3,683	3,771	300	(²)	118	117
Stone, clay, and glass products....	32	352	401	(²)	(²)	(²)	(²)	29,169	31,331	5,400	5,600	420	421
Primary metals.....	33	613	693	32	38	581	655	104,006	111,747	8,800	8,500	1,118	1,077
Fabricated metal products and ordnance.....	34	479	588	43	53	436	535	43,084	45,130	8,900	9,300	669	666
Machinery.....	35	5,131	6,076	670	855	4,461	5,221	100,897	108,695	63,800	65,200	1,649	1,738
Electrical equipment.....	36	7,927	9,137	3,412	3,723	4,515	5,414	124,761	139,507	97,400	105,900	2,250	2,287
Transportation.....	37	12,865	14,624	(²)	(²)	(²)	(²)	197,456	189,554	122,700	127,900	2,511	2,386
Professional and scientific instruments.....	38	2,054	2,270	223	131	1,831	2,139	33,177	38,041	27,300	27,100	572	596
Miscellaneous manufacturing industries.....	39	141	162	10	21	131	141	6,758	7,164	1,700	1,800	209	215
Electric, gas, and sanitary services.....	49	229	220	22	21	207	199	64,549	77,870	1,300	1,400	424	430
Miscellaneous business services....	73	434	514	347	417	87	97	2,776	3,322	8,100	8,400	72	75
Miscellaneous services.....	89	183	195	77	88	106	107	3,412	4,139	3,500	3,900	56	59
Nonmanufacturing industries.....	(07-17,41-48, 50-67,807)	527	640	223	248	304	392	(³)	(³)	6,000	7,100	379	403

¹Industries, industry groups, and product fields shown separately in statistical tables are classified according to Standard Industrial Classification (SIC) manual codes. See section A, footnote 4.

²Not separately available but included in total.

³Category not available for reporting purposes.

SOURCE: National Science Foundation.

Table B-3. Funds for research and development by industry and size of company: 1956, 1958, 1963, 1967, and 1969-80

[Dollars in millions]

Industry and size of company	SIC code	1956	1958	1963	1967	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980
Total.....		\$6,605	\$8,389	\$12,630	\$16,385	\$18,308	\$18,067	\$18,320	\$19,552	\$21,249	\$22,887	\$24,187	\$26,997	\$29,928	\$33,365	\$38,147	\$43,879
DISTRIBUTION BY INDUSTRY																	
Food and kindred products.....	20	64	83	130	183	199	230	240	259	269	298	335	355	395	429	459	517
Textiles and apparel.....	22,23	(1)	26	30	57	60	58	59	61	64	69	70	82	81	84	93	102
Lumber, wood products, and furniture.....	24,25	(1)	12	11	12	18	52	53	64	71	84	88	107	127	133	151	165
Paper and allied products.....	26	36	42	69	128	188	178	187	189	194	237	249	313	336	391	454	508
Chemicals and allied products.....	28	641	792	1,239	1,507	1,660	1,773	1,832	1,932	2,116	2,450	2,727	3,017	3,256	3,584	4,033	4,608
Industrial chemicals.....	281-82,286	460	553	809	966	1,007	1,031	1,009	1,031	1,119	1,299	1,391	1,524	1,685	1,835	2,023	2,273
Drugs and medicines.....	283	94	128	216	343	444	485	549	607	698	807	981	1,091	1,154	1,270	1,445	1,665
Other chemicals.....	284-85,287-89	87	111	214	198	209	257	274	294	299	344	354	401	417	479	565	670
Petroleum refining and related industries.....	29	182	246	317	371	467	515	505	468	498	622	693	767	918	1,060	1,275	1,565
Rubber products.....	30	(1)	89	156	182	261	276	289	377	426	469	467	502	491	488	571	646
Stone, clay, and glass products.....	32	260	275	100	136	159	167	164	183	199	217	233	263	287	321	352	401
Primary metals.....	33	90	131	183	242	257	275	272	277	307	358	443	506	534	549	613	693
Ferrous metals and products ¹	331-32,3398-99	(1)	80	106	135	136	149	144	146	163	181	215	256	261	266	293	318
Nonferrous metals and products ¹	333-36	(1)	51	77	107	121	126	128	130	145	177	228	250	273	283	320	375
Fabricated metal products.....	34	116	162	153	163	182	207	242	253	291	313	324	358	394	396	479	588
Machinery.....	35	543	781	958	1,326	1,546	1,729	1,860	2,158	2,549	2,985	3,196	3,487	3,967	4,480	5,131	6,076
Office, computing, and accounting machines.....	357	(*)	(*)	(*)	(*)	(*)	(*)	(*)	1,456	1,733	2,103	2,220	2,402	2,766	3,134	3,611	4,287
Other machinery, except electrical.....	351-36,358-59	(*)	(*)	(*)	(*)	(*)	(*)	(*)	(*)	(*)	(*)	(*)	(*)	1,201	1,346	1,520	1,789
Electrical equipment.....	36	1,516	1,969	2,868	3,867	4,347	4,220	4,389	4,680	4,902	5,011	5,105	5,636	5,937	6,612	7,927	9,137
Radio and TV receiving equipment.....	365	(*)	(*)	(*)	45	57	70	64	48	49	51	50	52	61	52	62	89
Communication equipment.....	366	(1)	868	1,773	2,425	2,670	2,604	2,731	2,583	2,613	2,424	2,385	2,511	2,809	3,190	3,951	4,510
Electronic components.....	367	(1)	1,101	1,093	1,397	1,620	1,546	1,594	330	406	489	549	691	748	943	1,053	1,354
Other electrical equipment.....	361-64,369	(1)	1,101	1,093	1,397	1,620	1,546	1,594	1,719	1,834	2,047	2,121	2,382	2,318	2,527	2,861	3,184
Motor vehicles and motor vehicles equipment.....	371	688	856	1,090	1,354	1,568	1,591	1,768	1,954	2,405	2,389	2,340	2,778	3,325	3,841	4,421	4,843
Other transportation equipment.....	373-75,379	2,138	2,609	4,712	5,669	5,878	5,219	4,881	4,950	5,052	5,278	5,713	6,339	7,104	7,690	8,290	9,626
Aircraft and missiles.....	372,376	200	294	284	542	742	744	746	838	961	1,075	1,173	1,331	1,487	1,758	2,054	2,270
Professional and scientific instruments.....	38	97	156	70	104	123	131	133	163	186	221	266	325	390	493	601	735
Scientific and mechanical measuring instruments optical, surgical, photographic, and other instruments.....	381-82 383-87	103	138	214	438	619	613	612	675	775	854	907	1,007	1,097	1,265	1,453	1,535
Other manufacturing industries.....	21,27,31,39	(1)	105	54	90	121	128	131	146	158	177	205	217	250	283	317	410
Nonmanufacturing industries.....	07-17,41-67,737, 739,807,891	(1)	117	276	559	655	705	704	707	715	768	735	845	921	1,138	1,373	1,569
DISTRIBUTION BY SIZE OF COMPANY (BASED ON NUMBER OF EMPLOYEES)																	
Less than 1,000.....		369	532	619	687	(1)	904	884	929	940	1,058	1,222	1,384	1,321	1,354	1,615	1,818
1,000 to 4,999.....		2,550	642	1,022	1,017	(1)	1,233	1,195	1,215	1,248	1,370	1,385	1,500	1,551	1,966	2,527	2,769
5,000 to 9,999.....					892	1,033	1,095	1,170	1,076	1,168	1,346	1,478	1,648	1,859	1,611	1,775	2,147
10,000 to 24,999.....									2,159	2,236	2,416	2,633	2,874	3,371	4,144	4,933	5,583
25,000 or more.....		25,686	7,215	10,989	13,790	15,435	14,835	15,071	14,173	15,657	16,697	17,469	19,591	21,826	24,290	27,297	31,562

¹Not separately available but included in total.²Estimated by the National Science Foundation.³SIC codes 3398 and 3399 included in the nonferrous metals and products group for 1956-63.⁴Data not tabulated at this level prior to 1972.⁵Data not tabulated at this level prior to 1977.⁶Included in the other electrical equipment group.

SOURCE: National Science Foundation.

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Table B-4. Funds for research and development by industry and selected company size groups: 1980

[Dollars in millions]

Industry	SIC code	Total	Companies with total employment of--		
			5,000 to 9,999	10,000 to 24,999	25,000 or more
Total.....	.....	\$43,879	\$2,147	\$5,583	\$31,562
Food and kindred products.....	20	517	73	131	221
Textiles and apparel.....	22,23	102	7	44	13
Lumber, wood products, and furniture.....	24,25	165	22	(¹)	(¹)
Paper and allied products.....	26	508	(¹)	121	(¹)
Chemicals and allied products.....	28	4,608	529	1,550	1,979
Industrial chemicals.....	281-82,286	2,273	224	364	1,547
Drugs and medicines.....	283	1,665	234	988	258
Other chemicals.....	284-85,287-89	670	71	198	(¹)
Petroleum refining and related industries....	29	1,565	(¹)	105	1,357
Rubber products.....	30	646	59	(¹)	415
Stone, clay, and glass products.....	32	401	8	207	(¹)
Primary metals.....	33	693	55	181	336
Ferrous metals and products.....	331-32,3398-99	318	11	35	(¹)
Nonferrous metals and products.....	333-36	375	44	146	(¹)
Fabricated metal products.....	34	588	108	82	231
Machinery.....	35	6,076	259	455	4,697
Office, computing, and accounting machines.	357	4,287	108	158	3,844
Other machinery, except electrical.....	351-56,358-59	1,789	151	297	853
Electrical equipment.....	36	9,137	337	800	7,114
Radio and TV receiving equipment.....	365	89	0	(¹)	(¹)
Communication equipment.....	366	4,510	180	(¹)	3,871
Electronic components.....	367	1,354	105	275	(¹)
Other electrical equipment.....	361-64,369	3,184	52	284	2,589
Motor vehicles and motor vehicles equipment..	371	4,843	40	151	4,582
Other transportation equipment.....	373-75,379	155	(¹)	64	0
Aircraft and missiles.....	372,376	9,626	222	771	8,451
Professional and scientific instruments.....	38	2,270	140	391	1,331
Scientific and mechanical measuring instruments.....	381-82	735	71	(¹)	(¹)
Optical, surgical, photographic, and other instruments.....	383-87	1,535	69	(¹)	(¹)
Other manufacturing industries.....	21,27,31,39	410	51	130	121
Nonmanufacturing industries.....	{ 07-17,41-67,737,739,807,891 }	1,569	173	277	294

¹Not separately available but included in total.

SOURCE: National Science Foundation.

Table B-5. Funds for research and development by industry, size of company, and size of R&D program: 1980

Industry and size of company	SIC code	Total	Size of R&D program [thousands of dollars]				
			Less than \$200	\$200 to \$999	\$1,000 to \$9,999	\$10,000 to \$99,999	\$100,000 or more
			[Dollars in millions]				
Total.....	.....	\$43,879	\$416	\$700	\$2,670	\$8,996	\$31,097
DISTRIBUTION BY INDUSTRY							
Food and kindred products.....	20	517	7	19	198	293	0
Textiles and apparel.....	22,23	102	12	16	61	13	0
Lumber, wood products, and furniture.....	24,25	165	14	14	33	104	0
Paper and allied products.....	26	508	4	35	(¹)	191	(¹)
Chemicals and allied products.....	28	4,608	36	53	244	1,848	2,427
Industrial chemicals.....	281-82,286	2,273	4	16	86	632	1,535
Drugs and medicines.....	283	1,665	5	8	(¹)	895	(¹)
Other chemicals.....	284-85,287-89	670	27	29	(¹)	321	(¹)
Petroleum refining and related industries.....	29	1,565	3	1	46	419	1,096
Rubber products.....	30	646	14	(¹)	(¹)	(¹)	(¹)
Stone, clay, and glass products.....	32	401	20	23	57	301	0
Primary metals.....	33	693	10	18	150	515	0
Ferrous metals and products.....	331-32,3398-99	318	3	12	60	243	0
Nonferrous metals and products.....	333-36	375	7	6	90	272	0
Fabricated metal products.....	34	588	41	39	154	354	0
Machinery.....	35	6,076	69	110	493	723	4,681
Office, computing, and accounting machines.....	357	4,287	2	13	70	358	3,844
Other machinery, except electrical.....	351-56,358-59	1,789	67	97	423	365	837
Electrical equipment.....	36	9,137	60	117	380	1,565	7,015
Radio and TV receiving equipment.....	365	89	(¹)	7	(¹)	(¹)	0
Communication equipment.....	366	4,510	16	42	121	397	3,934
Electronic components.....	367	1,354	(¹)	31	117	(¹)	(¹)
Other electrical equipment.....	361-64,369	3,184	34	37	(¹)	603	(¹)
Motor vehicles and motor vehicles equipment.....	371	4,843	12	12	41	205	4,573
Other transportation equipment.....	373-75,379	155	3	(¹)	28	(¹)	0
Aircraft and missiles.....	372,376	9,626	10	6	37	432	9,141
Professional and scientific instruments.....	38	2,270	40	87	257	330	1,556
Scientific and mechanical measuring instruments	381-82	735	20	61	(¹)	161	(¹)
Optical, surgical, photographic, and other instruments.....	383-87	1,535	20	26	(¹)	169	(¹)
Other manufacturing industries.....	21,27,31,39	410	21	21	95	273	0
Nonmanufacturing industries.....	{ 07-17,41-67,737,739,807,891 }	1,565	40	105	261	911	248
DISTRIBUTION BY SIZE OF COMPANY (BASED ON NUMBER OF EMPLOYEES)							
Less than 1,000.....	.....	1,818	397	534	648	239	0
1,000 to 4,999.....	.....	2,769	16	138	1,106	1,300	209
5,000 to 9,999.....	.....	2,147	(¹)	19	487	1,559	(¹)
10,000 to 24,999.....	.....	5,583	(¹)	(¹)	339	3,585	(¹)
25,000 or more.....	.....	31,562	(¹)	(¹)	90	2,313	29,157

¹Not separately available but included in total.

SOURCE: National Science Foundation.

BEST DOCUMENT AVAILABLE

Table B-6. Company funds for research and development by industry and size of company: 1957-58, 1963, 1967, and 1969-80

[Dollars in millions]																	
Industry and size of company	SIC code	1957	1958	1963	1967	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980
Total.....		\$3,396	\$3,630	\$5,360	\$8,020	\$9,857	\$10,288	\$10,654	\$11,535	\$13,104	\$14,667	\$15,582	\$17,436	\$19,407	\$22,156	\$25,655	\$29,940
DISTRIBUTION BY INDUSTRY																	
Food and kindred products.....	20	74	77	(1)	181	198	227	238	258	268	297	(1)	(1)	(1)	(1)	(1)	(1)
Textiles and Apparel.....	22,23	14	20	(1)	(1)	(1)	(1)	59	61	63	(1)	(1)	(1)	(1)	(1)	(1)	(1)
Lumber, wood products, and furniture.....	24,25	14	12	(1)	12	18	52	(1)	(1)	(1)	(1)	38	106	127	133	151	165
Paper and allied products.....	26	35	42	69	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)
Chemicals and allied products.....	28	616	666	1,004	1,297	1,468	1,593	1,648	1,741	1,913	2,236	2,490	2,751	2,956	3,218	3,655	4,201
Industrial chemicals.....	281-82,286	423	443	662	785	842	873	850	860	936	1,105	1,173	1,275	1,402	1,488	1,633	1,887
Drugs and medicines.....	283	104	126	207	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)
Other chemicals.....	284-85,287-89	89	97	135	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)
Petroleum refining and related industries.....	29	200	234	296	355	457	493	488	454	485	603	(1)	715	842	939	1,120	1,414
Rubber products.....	30	70	68	111	160	196	205	221	255	280	(1)	(1)	(1)	(1)	(1)	(1)	(1)
Stone, clay, and glass products.....	32	(1)	(1)	97	134	158	156	153	168	184	203	(1)	(1)	(1)	(1)	(1)	(1)
Primary metals.....	33	103	117	174	234	247	265	266	264	297	350	422	481	507	521	581	655
Ferrous metals and products ²	331-32,3398-99	63	78	105	134	135	148	142	144	159	(1)	211	252	256	261	288	313
Nonferrous metals and products ²	333-36	40	39	69	100	112	117	124	121	138	(1)	211	229	251	260	293	342
Fabricated metal products.....	34	97	105	129	151	174	201	230	243	279	299	297	322	349	359	436	535
Machinery.....	35	397	438	709	1,004	1,286	1,469	1,545	1,758	2,120	2,473	2,687	2,955	3,391	3,888	4,461	5,221
Office, computing, and accounting machines.....	357	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	1,734	1,893	2,220	2,582	2,988	3,493
Other machinery, except electrical.....	351-56,358-59	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	1,171	1,306	1,473	1,728
Electrical equipment.....	36	608	632	1,017	1,571	1,957	2,008	2,131	2,313	2,491	2,704	2,798	3,081	3,238	3,741	4,515	5,414
Radio and TV receiving equipment.....	365	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	52	61	52	62	89
Communication equipment.....	366	230	253	564	930	1,113	1,183	1,252	1,165	1,251	1,287	1,328	1,418	1,607	1,876	2,252	2,703
Electronic components.....	367	378	379	453	(1)	(1)	(1)	(1)	205	260	306	(1)	(1)	(1)	(1)	(1)	(1)
Other electrical equipment.....	361-64,369	378	379	453	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)
Motor vehicles and motor vehicles equipment.....	371	517	560	799	994	1,278	1,278	1,461	1,661	2,020	2,101	2,022	2,395	2,887	3,348	3,743	4,240
Other transportation equipment.....	373-75,379	299	333	452	1,138	1,354	1,213	1,017	29	33	40	43	(1)	(1)	(1)	(1)	(1)
Aircraft and missiles.....	372,376	140	157	202	353	505	550	583	1,154	1,278	1,285	1,418	1,563	1,879	2,293	2,730	3,493
Professional and scientific instruments.....	38	59	63	53	67	91	111	120	801	908	1,001	1,168	1,313	1,575	1,831	2,139	2,730
Scientific and mechanical measuring instruments, optical, surgical, photographic, and other instruments.....	381-82	81	94	149	286	414	439	463	151	175	211	251	309	368	467	566	691
Instruments.....	383-87	81	94	149	286	414	439	463	527	628	697	750	859	945	1,108	1,265	1,448
Other manufacturing industries.....	21,27,31,39	19	33	52	88	(1)	(1)	(1)	(1)	(1)	(1)	198	212	245	274	303	362
Nonmanufacturing industries.....	07-17,41-67,737,739,807,891	(1)	55	85	172	207	225	252	277	299	305	425	471	506	616	704	795
DISTRIBUTION BY SIZE OF COMPANY (BASED ON NUMBER OF EMPLOYEES)																	
Less than 1,000.....		375	299	425	459	(1)	540	565	603	633	691	949	1,085	1,110	1,137	1,231	1,451
1,000 to 9,999.....		*406	*440	596	666	(1)	821	828	843	891	992	1,132	1,231	1,260	1,511	1,740	1,994
5,000 to 9,999.....					642	775	884	956	890	981	1,116	1,190	1,334	1,480	1,393	1,590	1,762
10,000 to 24,999.....		*2,615	*2,891	4,338					1,540	1,731	1,986	2,262	2,325	2,576	3,173	3,939	4,679
25,000 or more.....					6,254	7,909	8,043	8,305	7,659	8,868	9,882	10,049	11,461	12,981	14,942	17,155	20,054

Note: Company funds include all funds for industrial R&D work performed within company facilities except funds provided by the Federal Government. Excluded are company-financed research and development contracted to outside organizations such as research institutions, universities and colleges, or other nonprofit organizations.

¹Not separately available but included in total.

²SIC codes 3398 and 3399 included in the nonferrous metals and products group for 1957-63.

³Data not tabulated at this level prior to 1972.

⁴Data not tabulated at this level prior to 1977.

⁵Included in the other electrical equipment group.

*Estimated by the National Science Foundation.

SOURCE: National Science Foundation

Table B-7. Company funds for research and development by industry and selected company size groups: 1980

[Dollars in millions]

Industry	SIC code	Total	Companies with total employment of--		
			5,000 to 9,999	10,000 to 24,999	25,000 or more
Total.....	.....	\$29,940	\$1,762	\$4,679	\$20,054
Food and kindred products.....	20	(¹)	73	131	221
Textiles and apparel.....	22,23	(¹)	7	(¹)	13
Lumber, wood products, and furniture.....	24,25	165	22	(¹)	(¹)
Paper and allied products.....	26	(¹)	(¹)	121	(¹)
Chemicals and allied products.....	28	4,201	529	1,531	1,593
Industrial chemicals.....	281-82,286	1,887	224	(¹)	1,165
Drugs and medicines.....	283	(¹)	234	986	(¹)
Other chemicals.....	284-85,287-89	(¹)	71	(¹)	(¹)
Petroleum refining and related industries....	29	1,414	(¹)	(¹)	(¹)
Rubber products.....	30	(¹)	(¹)	(¹)	270
Stone, clay, and glass products.....	32	(¹)	8	207	(¹)
Primary metals.....	33	655	52	171	325
Ferrous metals and products.....	331-32,3398-99	313	11	(¹)	(¹)
Nonferrous metals and products.....	333-36	342	41	(¹)	(¹)
Fabricated metal products.....	34	535	108	(¹)	(¹)
Machinery.....	35	5,221	(¹)	449	3,900
Office, computing, and accounting machines..	357	3,493	108	(¹)	3,055
Other machinery, except electrical.....	351-56,358-59	1,728	(¹)	(¹)	(¹)
Electrical equipment.....	36	5,414	214	647	3,871
Radio and TV receiving equipment.....	365	89	0	(¹)	(¹)
Communication equipment.....	366	2,703	(¹)	(¹)	2,331
Electronic components.....	367	(¹)	(¹)	(¹)	(¹)
Other electrical equipment.....	361-64,369	(¹)	(¹)	(¹)	(¹)
Motor vehicles and motor vehicles equipment..	371	4,240	(¹)	(¹)	(¹)
Other transportation equipment.....	373-75,379	(¹)	(¹)	(¹)	0
Aircraft and missiles.....	372,376	2,730	73	226	2,370
Professional and scientific instruments.....	38	2,139	(¹)	(¹)	1,266
Scientific and mechanical measuring instruments.....	381-82	691	(¹)	(¹)	(¹)
Optical, surgical, photographic, and other instruments.....	383-87	1,448	69	(¹)	(¹)
Other manufacturing industries.....	21,27,31,39	362	51	(¹)	(¹)
Nonmanufacturing industries.....	{07-17,41-67,737,739,807,891}	795	96	(¹)	216

¹Not separately available but included in total.

SOURCE: National Science Foundation.

Table B-8. Company research and development performed by foreign affiliates of U.S. domestic companies outside the United States by selected industry: 1974-80

[Dollars in millions]

Industry	SIC code	1974 ¹	1975	1976	1977	1978	1979	1980
Total.....		\$1,300	\$1,454	\$1,659	\$1,877	\$2,209	\$2,782	\$3,196
Food and kindred products.....	20	27	23	29	32	44	53	57
Chemicals and allied products.....	28	208	269	312	332	399	505	613
Industrial and other chemicals.....	281-82,284-89	82	85	108	133	153	201	249
Drugs and medicines.....	283	126	184	204	199	246	304	364
Stone, clay, and glass products.....	32	7	7	(²)	(²)	(²)	18	21
Primary metals.....	33	3	9	12	10	11	14	15
Fabricated metal products.....	34	(²)	(²)	22	24	29	32	(³)
Machinery.....	35	258	331	352	415	469	550	626
Electrical equipment.....	36	238	245	278	306	363	468	484
Electronic components.....	367	4	7	9	13	17	25	29
Other electrical equipment.....	361-64,369	(³)	(³)	6	6	13	17	21
Radio and TV receiving equipment; communication equipment.....	365-66	(³)	(³)	(³)	(³)	(³)	(³)	(³)
Transportation.....	37	406	412	464	552	621	840	962
Motor vehicles and other trans- portation equipment.....	371,373-75	364	373	423	508	(³)	(³)	(³)
Aircraft and missiles.....	372-76	42	39	41	44	(³)	(³)	(³)
Professional and scientific instruments.....	38	39	49	49	53	65	83	97
Other manufacturing industries.....	21-27,29-31,39	111	105	137	144	181	215	282
Nonmanufacturing industries.....	{ 07-17,41-67,737, 739,807,891 }	3	4	4	9	11	4	6

¹Based on data obtained from the top 200 U.S. R&D performing companies.

²Included in the other manufacturing industries group

³Not separately available but included in higher level total.

SOURCE: National Science Foundation.

Table B-9. Company funds for R&D performance by selected industry: 1980 actual and 1981 projected

[Dollars in millions]

Industry	SIC code	Actual 1980	1981 (projected)
Total.....	.....	\$29,940	\$32,302
Chemicals and allied products.....	28	4,201	4,743
Industrial chemicals.....	281-82,286	1,887	2,148
Machinery.....	35	5,221	5,536
Electrical equipment.....	36	5,414	6,241
Communication equipment.....	366	2,703	3,215
Motor vehicles and motor vehicles equipment.....	371	4,240	4,246
Aircraft and missiles.....	372,376	2,730	3,246

SOURCE: National Science Foundation.

Table 8-10. Federal funds for research and development by industry and size of company: 1957-58, 1963, 1967, and 1969-80

(Dollars in millions)

Industry and size of company	SIC code	1957	1958	1963	1967	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980
Total		4,335	74,759	77,270	78,365	78,451	77,779	77,666	78,017	78,145	78,220	78,605	79,561	810,521	811,209	812,492	813,939
DISTRIBUTION BY INDUSTRY																	
Food and kindred products	20	(¹)	6	(²)	2	4	3	2	1	1	1	(²)	(²)	(²)	(²)	(²)	(²)
Textiles and apparel ²	22,23	(³)	(³)	(²)	(²)	(²)	(²)	1	1	1	(²)	(²)	(²)	(²)	(²)	(²)	(²)
Lumber, wood products, and furniture ³	24,25	(³)	(³)	(²)	0	0	0	(²)	(²)	(²)	(²)	0	0	0	0	0	0
Paper and allied products	26	(⁴)	0	0	(²)	(²)	(²)	(²)	2	(²)	(²)	(²)	(²)	(²)	(²)	(²)	(²)
Chemicals and allied products	28	89	126	234	210	192	180	184	189	203	214	236	266	300	366	378	407
Industrial chemicals	281-82,286	80	110	146	181	165	158	159	171	183	194	218	249	284	347	360	386
Drugs and medicines	283	(⁴)	2	9	(²)	(²)	(²)	(²)	(²)	(²)	(²)	(²)	(²)	(²)	(²)	(²)	(²)
Other chemicals	284-85,287-89	9	14	79	(²)	(²)	(²)	(²)	(²)	(²)	(²)	(²)	(²)	(²)	(²)	(²)	(²)
Petroleum refining and related industries	29	11	12	21	16	10	22	17	15	14	20	(²)	52	76	121	155	151
Rubber products	30	37	21	46	22	65	71	69	123	146	(²)	(²)	(²)	(²)	(²)	(²)	(²)
Stone, clay, and glass products	32	(²)	(²)	3	2	1	11	10	14	15	14	(²)	(²)	(²)	(²)	(²)	(²)
Primary metals	33	5	14	10	8	10	13	6	12	11	8	21	26	25	28	32	38
Ferrous metals and products ⁴	331-32,3398-99	1	2	2	1	2	1	2	3	4	(²)	3	4	4	5	5	5
Nonferrous metals and products ⁴	333-36	4	12	8	6	9	9	4	10	7	(²)	17	22	21	23	27	33
Fabricated metal products	34	38	57	24	13	8	7	11	12	13	14	27	36	45	37	43	53
Machinery	35	272	343	250	322	260	262	315	401	429	511	509	532	576	592	670	855
Office, computing, and accounting machines	357	(⁵)	(⁵)	(⁵)	(⁵)	(⁵)	(⁵)	(⁵)	(²)	(²)	(²)	486	509	546	552	623	794
Other machinery, except electrical	351-36,358-59	(⁶)	(⁶)	(⁶)	(⁶)	(⁶)	(⁶)	(⁶)	(⁶)	(⁶)	(⁶)	(⁶)	(⁶)	30	40	47	61
Electrical equipment	36	1,196	1,337	1,849	2,296	2,390	2,211	2,258	2,367	2,410	2,307	2,307	2,555	2,699	2,871	3,412	3,723
Radio and TV receiving equipment	365	(⁷)	(⁷)	(⁷)	(²)	(²)	(²)	(²)	(²)	(²)	(²)	(²)	0	0	0	0	0
Communication equipment	366	(⁷)	(⁷)	(⁷)	(²)	(²)	(²)	(²)	(²)	(²)	(²)	(²)	0	0	0	0	0
Electronic components	367	(⁷)	(⁷)	(⁷)	(²)	(²)	(²)	(²)	(²)	(²)	(²)	(²)	(²)	(²)	(²)	(²)	(²)
Other electrical equipment	361-64,369	518	615	1,209	1,495	1,557	1,420	1,479	1,417	1,362	1,137	1,057	1,093	1,202	1,314	1,699	1,807
Motor vehicles and motor vehicles equipment	371	(⁷)	(⁷)	(⁷)	(²)	(²)	(²)	(²)	(²)	(²)	(²)	(²)	(²)	(²)	(²)	(²)	(²)
Other transportation equipment	373-75,379	190	296	291	360	290	314	309	293	385	288	318	383	438	493	678	603
Aircraft and missiles	372,376	2,275	2,276	4,261	4,531	4,524	4,005	3,864	3,970	3,899	4,000	4,428	4,921	5,341	5,811	5,997	6,896
Professional and scientific instruments	38	109	137	81	189	237	194	164	161	160	167	172	163	174	183	223	131
Scientific and mechanical measuring instruments	381-82	80	93	16	37	32	20	14	13	11	10	15	15	22	26	35	44
Optical, surgical, photographic, and other instruments	383-87	29	44	65	152	205	174	150	148	149	157	157	148	152	157	188	87
Other manufacturing industries	21,27,31,39	74	72	3	(²)	(²)	(²)	(²)	(²)	(²)	(²)	7	5	6	9	14	48
Nonmanufacturing industries ⁵	17-17,41-67,737,739,807,891	0	62	190	387	448	480	452	431	416	463	310	375	415	522	669	774
DISTRIBUTION BY SIZE OF COMPANY (BASED ON NUMBER OF EMPLOYEES)																	
Less than 1,000		167	233	194	228	(²)	364	318	326	307	367	273	299	211	217	384	367
1,000 to 4,999		226	*202	425	351	(²)	412	367	372	357	378	253	270	291	455	787	775
5,000 to 9,999					251	257	211	214	186	187	230	288	313	379	218	185	385
10,000 to 24,999									619	505	430	371	548	795	971	994	904
25,000 or more		3,942	*4,324	6,651	7,536	7,525	6,792	6,766	6,514	6,789	6,815	7,420	8,130	8,845	9,348	10,142	11,508

¹Less than 20.5 million.²Not separately available but included in total.³For 1957 and 1958 textiles and apparel and lumber, wood products, and furniture are included in nonmanufacturing industries.⁴SIC codes 3398 and 3399 included in the nonferrous metals and products group for 1957-63.⁵Data not tabulated at this level prior to 1972.⁶Data not tabulated at this level prior to 1977.⁷Included in the other electrical equipment group.⁸Estimated by the National Science Foundation.

SOURCE: National Science Foundation.

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Table B-11. Federal funds for research and development by industry and selected company size groups: 1980

[Dollars in millions]

Industry	SIC code	Total	Companies with total employment of--		
			5,000 to 9,999	10,000 to 24,999	25,000 or more
Total.....	.....	\$13,939	\$385	\$904	\$11,508
Food and kindred products.....	20	(¹)	0	0	0
Textiles and apparel.....	22,23	(¹)	0	(¹)	0
Lumber, wood products, and furniture.....	24,25	0	0	0	0
Paper and allied products.....	26	(¹)	0	0	(¹)
Chemicals and allied products.....	28	407	0	19	386
Industrial chemicals.....	281-82,286	386	(¹)	(¹)	382
Drugs and medicines.....	283	(¹)	0	2	(¹)
Other chemicals.....	284-85,287-89	(¹)	0	(¹)	0
Petroleum refining and related industries....	29	151	0	(¹)	(¹)
Rubber products.....	30	(¹)	(¹)	0	145
Stone, clay, and glass products.....	32	(¹)	0	0	(¹)
Primary metals.....	33	38	3	10	11
Ferrous metals and products.....	331-32,3398-99	5	0	(¹)	(¹)
Nonferrous metals and products.....	333-36	33	3	(¹)	(¹)
Fabricated metal products.....	34	53	0	(¹)	(¹)
Machinery.....	35	855	(¹)	6	797
Office, computing, and accounting machines.	357	794	0	(¹)	(¹)
Other machinery, except electrical.....	351-56,358-59	61	(¹)	(¹)	(¹)
Electrical equipment.....	36	3,723	123	153	3,243
Radio and TV receiving equipment.....	365	0	0	0	0
Communication equipment.....	366	1,807	(¹)	(¹)	1,540
Electronic components.....	367	(¹)	(¹)	(¹)	(¹)
Other electrical equipment.....	361-64,369	(¹)	(¹)	(¹)	(¹)
Motor vehicles and motor vehicles equipment..	371	603	(¹)	(¹)	(¹)
Other transportation equipment.....	373-75,379	(¹)	(¹)	(¹)	0
Aircraft and missiles.....	372,376	6,896	149	545	6,081
Professional and scientific instruments.....	38	131	(¹)	(¹)	(¹)
Scientific and mechanical measuring instruments.....	381-82	44	(¹)	(¹)	0
Optical, surgical, photographic, and other instruments.....	383-87	87	0	(¹)	(¹)
Other manufacturing industries.....	21,27,31,39	48	0	(¹)	(¹)
Nonmanufacturing industries.....	{ 07-17,41-67,737,739,807,891 }	774	77	(¹)	78

¹Not separately available but included in total.

SOURCE: National Science Foundation.

Table B-12. R&D-performing companies with 1,000 or more employees and number with Federal R&D funds by industry and size of company: 1980

Industry	SIC code	Companies with total employment of-									
		1,000 or more		1,000 to 4,999		5,000 to 9,999		10,000 to 24,999		25,000 or more	
		Total	Federal	Total	Federal	Total	Federal	Total	Federal	Total	Federal
Total.....		1,398	242	833	70	230	46	205	53	130	73
Food and kindred products.....	20	105	2	59	2	20	0	17	0	9	0
Textiles and apparel.....	22,23	76	1	45	0	12	0	15	1	4	0
Lumber, wood products, and furniture.....	24,25	47	1	31	0	10	0	4	0	2	1
Paper and allied products.....	26	51	2	32	1	4	0	9	0	6	1
Chemicals and allied products.....	28	107	21	51	2	22	4	23	8	11	7
Industrial chemicals.....	281-82,286	35	13	11	2	11	4	7	2	6	5
Drugs and medicines.....	283	29	5	10	0	5	0	10	3	4	2
Other chemicals.....	284-85,287-89	43	3	30	0	6	0	6	3	1	0
Petroleum refining and related industries....	29	26	14	8	2	2	1	5	2	11	9
Rubber products.....	30	43	8	27	2	8	3	4	0	4	3
Stone, clay, and glass products.....	32	50	5	32	2	5	0	11	2	2	1
Primary metals.....	33	112	19	73	3	13	5	14	6	12	5
Ferrous metals and products.....	33-32,3398-99	56	7	37	2	5	1	5	1	9	3
Nonferrous metals and products.....	333-36	56	12	36	1	8	4	9	5	3	2
Fabricated metal products.....	34	85	10	52	3	20	1	8	4	5	2
Machinery.....	35	161	19	104	8	25	2	20	4	12	5
Office, computing, and accounting machines.	357	25	6	10	2	4	0	4	1	7	3
Other machinery, except electrical.....	351-56,358-59	136	13	94	6	21	2	16	3	5	2
Electrical equipment.....	36	153	45	98	16	20	11	17	5	18	13
Radio and TV receiving equipment.....	365	7	0	5	0	0	0	1	0	1	0
Communication equipment.....	366	36	20	21	7	6	5	2	2	7	6
Electronic components.....	367	40	12	29	6	5	2	3	1	3	3
Other electrical equipment.....	361-64,369	70	13	43	3	9	4	11	2	7	4
Motor vehicles and motor vehicles equipment..	371	34	8	18	0	6	2	5	2	5	4
Other transportation equipment.....	373-75,379	17	5	11	1	1	1	4	2	1	1
Aircraft and missiles.....	372,376	44	29	17	4	5	4	8	7	14	14
Professional and scientific instruments.....	38	65	14	43	7	11	1	7	3	4	3
Scientific and mechanical measuring instruments.....	381-82	31	8	21	5	6	1	3	1	1	1
Optical, surgical, photographic, and other instruments.....	383-87	34	6	22	2	5	0	4	2	3	2
Other manufacturing industries.....	21,27,31,39	97	4	65	1	16	0	11	1	5	2
Nonmanufacturing industries.....	{ 07-17,41-67,737,739,807,891 }	125	35	67	16	30	11	23	6	5	2

Note: Data not available for companies with less than 1,000 employees.

SOURCE: National Science Foundation.

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Table B-13. Industry-administered federally funded research and development centers--composition of work force and funds by character of work: 1979-80

[Dollars in millions]

Item	1979	1980
Total R&D funds ¹	\$1,164	\$1,320
Basic research.....	104	(²)
Applied research.....	250	(²)
Development.....	810	(²)
January		
	1980	1981
Full-time-equivalent R&D scientists and engineers.....	9,420	9,860
March		
	1979	1980
Total employment.....	33,136	33,745

¹All of these funds were devoted to Federal R&D activities.

²Data not collected for 1978.

SOURCE: National Science Foundation.

Table B-14. R&D-performing companies in manufacturing and nonmanufacturing industries by size of company: 1980

Size of company (based on number of employees)	Number of companies reporting R&D funds		
	Total	Manu- facturing	Nonmanu- facturing
Total.....	14,998	(¹)	(¹)
Less than 1,000....	² 13,600	(¹)	(¹)
1,000 to 4,999.....	833	766	67
5,000 to 9,999.....	230	200	30
10,000 to 24,999...	205	182	23
25,000 or more.....	130	125	5

¹Not separately available but included in total.

²This estimate represents the midpoint of a range from 10,700 to 16,500.

SOURCE: National Science Foundation.

Table B-15. R&D-performing companies with 1,000 or more employees by size of company and R&D program: 1980

Size of company (based on number of employees)	Total	Size of R&D program [dollars in thousands]				
		Less than \$200	\$200 to \$999	\$1,000 to \$9,999	\$10,000 to \$99,999	\$100,000 or more
Total.....	1,398	197	323	521	280	77
1,000 to 4,999.....	833	172	274	325	60	2
5,000 to 9,999.....	230	18	34	109	62	7
10,000 to 24,999.....	205	6	12	71	105	11
25,000 or more.....	130	1	3	16	53	57

Note: Data not available for companies with less than 1,000 employees.

SOURCE: National Science Foundation.

Table B-16. R&D-performing manufacturing companies with 5,000 or more employees by industry and percent change in R&D funds: 1979-80

Industry	SIC code	Total number of companies	10 percent or more increase	10 percent or more decrease	Less than 10 percent change
Total.....	.....	507	286	57	164
Food and kindred products.....	20	46	22	1	23
Textiles and apparel.....	22,23	31	9	3	19
Lumber, wood products, and furniture.....	24,25	16	6	3	7
Paper and allied products.....	26	19	11	0	8
Chemicals and allied products.....	28	56	29	4	23
Industrial chemicals.....	281-82,286	24	12	4	8
Drugs and medicines.....	283	19	10	0	9
Other chemicals.....	284-85,287-89	13	7	0	6
Petroleum refining and related industries....	29	18	16	2	0
Rubber products.....	30	16	7	2	7
Stone, clay, and glass products.....	32	18	10	4	4
Primary metals.....	33	39	27	4	8
Ferrous metals and products.....	331-32,3398-99	19	11	1	7
Nonferrous metals and products.....	333-36	20	16	3	1
Fabricated metal products.....	34	33	22	3	8
Machinery.....	35	57	40	4	13
Office, computing, and accounting machines.	357	15	15	0	0
Other machinery, except electrical.....	351-56,358-59	42	25	4	13
Electrical equipment.....	36	55	33	9	13
Radio and TV receiving equipment.....	365	2	2	0	0
Communication equipment.....	366	15	9	4	2
Electronic components.....	367	11	9	1	1
Other electrical equipment.....	361-64,369	27	13	4	10
Motor vehicles and motor vehicles equipment..	371	16	7	2	7
Other transportation equipment.....	373-75,379	6	2	1	3
Aircraft and missiles.....	372,376	27	11	4	12
Professional and scientific instruments.....	38	22	12	3	7
Scientific and mechanical measuring instruments.....	381-82	10	6	1	3
Optical, surgical, photographic, and other instruments.....	383-87	12	6	2	4
Other manufacturing industries.....	21,27,31,39	32	22	8	2

Note: Manufacturing companies with 5,000 or more employees are classified into those increasing 10 percent or more, those decreasing 10 percent or more, or those changing less than 10 percent, based on their ratio of change for total R&D funds between 1979 and 1980.

SOURCE: National Science Foundation.

Table B-17. Percent of total, Federal, and company funds of R&D-performing companies ranked by size of R&D program: 1972-80

Companies ranked by size of R&D program (based on total R&D funds) ¹	1972	1973	1974	1975	1976	1977	1978	1979	1980
Percent of total R&D funds									
First 4 (1-4).....	18	19	20	20	20	20	19	20	18
Next 4 (5-8).....	16	15	15	15	14	14	14	13	12
Next 12 (9-20).....	21	22	21	19	20	19	19	19	18
Next 20 (21-40).....	12	11	11	12	12	13	13	13	14
Next 60 (41-100).....	13	13	15	15	15	15	15	15	16
Next 100 (101-200).....	7	8	8	8	8	9	9	9	10
Next 200 (201-400).....	6	6	6	6	6	6	6	6	6
Percent of Federal R&D funds									
First 4 (1-4).....	10	10	19	21	19	20	17	10	8
Next 4 (5-8).....	32	31	22	23	23	23	24	27	25
Next 12 (9-20).....	29	30	31	29	30	30	31	34	32
Next 20 (21-40).....	16	15	11	12	11	12	11	11	15
Next 60 (41-100).....	7	7	9	9	12	12	13	12	12
Next 100 (101-200).....	2	3	4	4	3	3	4	4	6
Next 200 (201-400).....	3	3	2	2	2	1	1	2	2
Percent of company R&D funds									
First 4 (1-4).....	24	25	20	19	20	20	20	24	24
Next 4 (5-8).....	5	5	11	10	9	8	9	7	6
Next 12 (9-20).....	15	15	13	13	13	13	13	12	12
Next 20 (21-40).....	9	9	11	11	12	13	13	14	13
Next 60 (41-100).....	17	17	17	17	17	16	16	17	18
Next 100 (101-200).....	11	11	11	10	11	12	11	11	11
Next 200 (201-400).....	8	8	8	8	8	8	8	8	8

¹Companies were ranked individually for each year; therefore, particular companies comprising the size groups may have changed from year to year.

SOURCE: National Science Foundation.

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Table B-18. Net sales of R&D-performing manufacturing companies by industry and selected company size groups: 1979-80

[Dollars in millions]

Industry	SIC code	1979				1980			
		Total	Companies with total employment of--			Total	Companies with total employment of--		
			5,000 to 9,999	10,000 to 24,999	25,000 or more		5,000 to 9,999	10,000 to 24,999	25,000 or more
Total.....		\$1,214,986	\$122,636	\$236,555	\$661,608	\$1,353,963	\$139,141	\$263,460	\$740,716
Food and kindred products.....	20	110,103	24,809	33,227	31,347	125,115	29,083	37,935	34,732
Textiles and apparel.....	22,23	25,053	2,900	9,804	(¹)	26,885	3,035	10,193	7,255
Lumber, wood products, and furniture.....	24,25	21,574	3,889	5,094	(¹)	21,815	3,746	5,068	(¹)
Paper and allied products.....	26	45,708	2,080	13,321	21,060	48,289	2,216	14,650	21,353
Chemicals and allied products.....	28	118,094	17,747	33,238	46,845	130,129	20,015	36,582	51,192
Industrial chemicals.....	281-82,286	63,353	10,700	13,142	32,637	69,127	12,077	14,066	35,589
Drugs and medicines.....	283	23,740	2,720	11,684	(¹)	26,715	2,934	13,439	(¹)
Other chemicals.....	284-85,287-89	31,001	4,327	8,412	(¹)	34,287	5,004	9,077	(¹)
Petroleum refining and related industries....	29	188,434	(¹)	27,651	149,350	260,103	(¹)	39,671	206,658
Rubber products.....	30	30,069	3,549	6,644	12,837	29,546	3,701	6,599	12,176
Stone, clay, and glass products.....	32	29,169	2,931	13,177	(¹)	31,331	2,962	14,275	(¹)
Primary metals.....	33	104,006	14,278	21,293	52,424	111,747	20,365	22,201	52,339
Ferrous metals and products.....	331-32,3398-99	62,417	3,358	6,127	43,668	61,789	3,428	6,048	43,095
Nonferrous metals and products.....	333-36	41,589	10,920	15,166	8,756	49,958	16,937	16,153	9,244
Fabricated metal products.....	34	43,084	8,800	7,962	12,259	45,130	9,104	7,988	13,141
Machinery.....	35	100,897	10,728	17,485	44,118	108,695	11,200	19,350	47,397
Office, computing, and accounting machines.	357	30,554	1,488	3,320	23,626	35,005	1,773	3,750	27,220
Other machinery, except electrical.....	351-56,358-59	70,343	9,240	14,165	20,492	73,690	9,427	15,600	20,177
Electrical equipment.....	36	124,761	6,322	14,857	83,801	139,507	6,981	15,900	94,537
Radio and TV receiving equipment.....	365	5,231	0	(¹)	3,083	5,606	0	(¹)	(¹)
Communication equipment.....	366	46,957	1,642	(¹)	39,549	52,219	1,829	(¹)	43,837
Electronic components.....	367	15,457	1,417	1,562	7,090	17,880	1,651	1,777	(¹)
Other electrical equipment.....	361-64,369	57,116	3,262	10,177	34,080	63,802	3,501	10,617	39,129
Motor vehicles and motor vehicles equipment..	371	116,049	4,628	7,688	100,055	97,613	4,292	7,049	83,083
Other transportation equipment.....	373-75,379	8,797	(¹)	(¹)	2,241	9,294	(¹)	3,047	(¹)
Aircraft and missiles.....	372,376	72,610	2,368	(¹)	53,216	82,647	2,764	8,115	61,970
Professional and scientific instruments.....	38	33,177	3,896	5,605	(¹)	38,041	4,255	6,118	16,877
Scientific and mechanical measuring instruments.....	381-82	10,476	1,865	2,410	(¹)	12,135	2,007	2,690	(¹)
Optical, surgical, photographic, and other instruments.....	383-87	22,701	2,031	3,195	12,190	25,906	2,248	3,428	(¹)
Other manufacturing industries.....	21,27,31,39	43,401	7,692	8,338	20,455	48,076	8,426	8,719	23,369

¹Not separately available but included in total.

SOURCE: National Science Foundation.

Table B-19. R&D funds as a percent of net sales in R&D-performing manufacturing companies by industry and size of company: 1957-58, 1963, and 1967-80

Industry and size of company	SIC code	1957	1958	1963	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980
Total.....		3.4	3.8	4.5	4.2	4.0	4.0	3.7	3.5	3.4	3.3	3.1	3.1	3.1	3.1	3.2	3.0	3.1
DISTRIBUTION BY INDUSTRY																		
Food and kindred products.....	20	.4	.3	.4	.5	.5	.4	.5	.5	.4	.4	.4	.4	.4	.4	.4	.4	.4
Textiles and apparel.....	22,23	(¹)	.3	.5	.5	.5	.6	.5	.5	.4	.4	.4	.4	.4	.4	.4	.4	.4
Lumber, wood products, and furniture.....	24,25	(¹)	.4	.5	.3	.4	.4	.8	.7	.8	.7	.8	.7	.7	.8	.7	.7	.8
Paper and allied products.....	26	.6	.7	.8	.9	.9	1.0	.9	.9	.8	.7	.8	.9	1.0	.9	1.0	1.0	1.1
Chemicals and allied products.....	28	3.5	3.8	4.3	4.6	3.8	3.9	3.9	3.7	3.6	3.5	3.5	3.7	3.7	3.7	3.6	3.4	3.5
Industrial chemicals.....	281-82,286	5.0	5.4	5.1	4.8	4.0	4.0	4.2	3.9	3.9	3.6	3.3	3.6	3.7	3.5	3.5	3.2	3.3
Drugs and medicines.....	283	3.6	4.1	4.7	6.1	6.0	6.0	6.7	6.2	6.5	6.5	6.3	6.4	6.3	6.4	6.3	6.1	6.2
Other chemicals.....	284-85,287-89	1.3	1.5	2.8	2.3	2.1	2.1	1.8	1.9	1.7	1.6	1.6	1.7	1.7	1.8	1.8	1.8	2.0
Petroleum refining and related industries.....	29	.7	1.1	1.0	.8	.8	.9	1.0	.9	.8	.7	.6	.7	.6	.7	.8	.7	.6
Rubber products.....	30	1.7	1.8	2.3	1.9	2.1	2.2	2.3	2.2	2.6	2.6	2.5	2.5	2.4	2.1	1.9	1.9	2.2
Stone, clay, and glass products.....	32	(²)	(²)	1.6	1.8	1.6	1.7	1.8	1.8	1.7	1.7	1.7	1.2	1.2	1.2	1.3	1.2	1.3
Primary metals.....	33	.5	.7	.8	.8	.8	.8	.8	.8	.7	.7	.6	.8	.8	.7	.6	.6	.6
Ferrous metals and products ³	331-32,3398-99	(¹)	.6	.7	.8	.7	.7	.7	.7	.6	.5	.5	.6	.6	.6	.5	.5	.5
Nonferrous metals and products ³	333-36	(¹)	.7	1.1	1.0	1.0	1.0	1.0	1.0	.9	.9	1.0	1.2	1.2	1.0	.9	.8	.8
Fabricated metal products.....	34	1.6	1.7	1.6	1.3	1.3	1.2	1.2	1.2	1.1	1.2	1.2	1.2	1.2	1.2	1.1	1.1	1.3
Machinery.....	35	3.4	3.8	4.2	4.2	4.0	3.8	4.0	4.0	4.3	4.6	4.6	4.8	4.9	5.1	5.0	5.1	5.6
Office, computing, and accounting machines.....	357	(⁴)	(⁴)	(⁴)	(⁴)	(⁴)	(⁴)	(⁴)	(⁴)	11.1	11.6	12.6	12.0	11.6	11.9	11.6	11.8	12.2
Other machinery, except electrical.....	351-56,358-59	(⁵)	(⁵)	(⁵)	(⁵)	(⁵)	(⁵)	(⁵)	(⁵)	(⁵)	(⁵)	(⁵)	(⁵)	(⁵)	2.2	2.2	2.2	2.4
Electrical equipment.....	36	7.6	10.3	10.1	8.6	8.4	7.9	7.3	7.2	7.1	6.9	6.6	6.5	6.7	6.2	6.3	6.4	6.5
Radio and TV receiving equipment.....	365	(⁶)	(⁶)	(⁶)	1.9	2.2	2.2	2.7	2.4	1.6	1.7	1.7	1.4	1.4	1.4	1.1	1.2	1.6
Communication equipment.....	366	(¹)	11.3	13.0	10.3	10.9	9.7	8.2	8.2	8.7	8.1	7.6	7.6	7.6	7.6	7.7	8.4	8.6
Electronic components.....	367	(¹)	9.7	7.3	7.3	6.8	6.6	6.6	6.4	5.9	6.2	6.2	6.9	7.3	6.9	8.0	6.8	7.6
Other electrical equipment.....	361-64,369	(¹)	9.7	7.3	7.3	6.8	6.6	6.6	6.4	6.3	6.3	6.3	6.0	6.3	5.3	5.3	5.0	5.0
Motor vehicles and motor vehicles equipment.....	371	2.9	4.2	3.4	3.4	3.1	3.1	3.5	3.1	3.3	3.5	3.7	3.5	3.2	3.1	3.3	3.8	5.0
Other transportation equipment.....	373-75,379	16.8	17.7	26.7	19.7	19.0	20.2	16.2	16.2	16.6	13.3	14.1	12.7	12.7	12.8	12.2	11.4	11.6
Aircraft and missiles.....	372,376	7.0	7.8	5.9	5.4	6.5	6.4	5.7	5.7	5.9	6.1	6.1	5.9	6.2	6.1	6.1	6.2	6.0
Professional and scientific instruments.....	38	9.5	10.2	4.1	3.9	4.1	3.8	3.5	3.7	4.1	4.3	4.5	4.9	5.4	5.9	5.8	5.7	6.1
Scientific and mechanical measuring instruments, Optical, surgical, photographic, and other instruments.....	381-82 383-87	5.2	6.3	6.9	6.0	7.4	7.4	6.6	6.4	6.6	6.8	6.7	6.3	6.4	6.2	6.3	6.4	5.9
Other manufacturing industries.....	21,27,31,39	(¹)	1.3	.7	.6	.8	.8	.8	.8	.8	.8	.9	.8	.7	.7	.7	.7	.9
DISTRIBUTION BY SIZE OF COMPANY (BASED ON NUMBER OF EMPLOYEES)																		
Less than 1,000.....		1.8	1.3	1.9	1.7	(¹)	(¹)	1.9	1.7	1.7	1.6	1.8	1.6	1.7	1.5	1.6	1.6	1.7
1,000 to 4,999.....		1.8	1.8	2.4	1.7	(¹)	(¹)	1.7	1.6	1.7	1.6	1.5	1.4	1.4	1.6	1.6	1.8	1.8
5,000 to 9,999.....		3.9	4.8	5.3	2.1	2.3	2.1	2.3	2.2	1.9	1.8	1.8	1.8	1.9	1.8	1.8	1.3	1.4
10,000 to 24,999.....					5.2	4.7	4.7	4.4	4.2	4.7	4.5	4.2	4.5	4.2	4.1	4.1	4.1	4.2
25,000 or more.....																		

¹Not separately available but included in total.²Included in the other manufacturing industries group.³SIC codes 3398 and 3399 included in the nonferrous metals and products group for 1957-63.⁴Data not tabulated at this level prior to 1972.⁵Data not tabulated at this level prior to 1977.⁶Included in the other electrical equipment group.⁷Separate data for companies with 5,000 or more employees and for companies with 1,000 to 4,999 employees were estimated by the National Science Foundation for 1957. Revisions of statistics by the U.S. Bureau of the Census for this year did not yield separate data for companies in these size groups.

SOURCE: National Science Foundation.

Table B-20. Company R&D funds as a percent of net sales in R&D-performing manufacturing companies by industry and size of company: 1957-58, 1963, and 1967-80

Industry and size of company	SIC code	1957	1958	1963	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980
Total.....		1.5	1.6	1.9	2.1	2.1	2.2	2.2	2.1	2.0	2.0	2.0	2.0	2.0	2.0	2.1	2.1	2.2
DISTRIBUTION BY INDUSTRY																		
Food and kindred products.....	20	.3	.3	(¹)	.5	.5	.4	.5	.5	.4	.4	.4	(¹)	(¹)	(¹)	(¹)	(¹)	(¹)
Textiles and apparel.....	22,23	(¹)	.2	.4	(¹)	(¹)	(¹)	(¹)	.5	.4	.4	(¹)	(¹)	(¹)	(¹)	(¹)	(¹)	(¹)
Lumber, wood products, and furniture.....	24,25	(¹)	.4	(¹)	.3	.4	.3	.8	(¹)	(¹)	(¹)	(¹)	.7	.7	.8	.7	.7	.8
Paper and allied products.....	26	.6	.7	.8	(¹)	(¹)	(¹)	(¹)	(¹)	.8	(¹)	(¹)	(¹)	(¹)	(¹)	(¹)	(¹)	(¹)
Chemicals and allied products.....	28	3.1	3.2	3.6	4.0	3.4	3.4	3.5	3.3	3.3	3.1	3.0	3.1	3.3	3.3	3.2	3.1	3.2
Industrial chemicals.....	281-82,286	4.2	4.3	4.1	3.9	3.3	3.4	3.6	3.3	3.2	3.0	2.8	3.1	3.1	3.0	2.8	2.6	2.7
Drugs and medicines.....	283	3.6	4.0	4.5	(¹)	(¹)	(¹)	(¹)	(¹)	(¹)	(¹)	(¹)	(¹)	(¹)	(¹)	(¹)	(¹)	(¹)
Other chemicals.....	284-85,287-89	1.2	1.3	1.8	(¹)	(¹)	(¹)	(¹)	(¹)	(¹)	(¹)	(¹)	(¹)	(¹)	(¹)	(¹)	(¹)	(¹)
Petroleum refining and related industries.....	29	.7	1.1	1.2	.8	.8	.9	.9	.8	.7	.7	.5	(¹)	.6	.6	.7	.6	.5
Rubber products.....	30	1.1	1.4	1.6	1.7	1.8	1.6	1.7	1.7	1.7	1.7	(¹)	(¹)	(¹)	(¹)	(¹)	(¹)	(¹)
Stone, clay, and glass products.....	32	(²)	(²)	1.6	1.7	1.6	1.7	1.7	1.6	1.6	1.5	1.5	(¹)	(¹)	(¹)	(¹)	(¹)	(¹)
Primary metals.....	33	.5	.6	.7	.8	.8	.8	.8	.8	.7	.6	.5	.7	.8	.7	.6	.6	.6
Ferrous metals and products ³	331-32,3398-99	(¹)	.6	.7	.7	.7	.7	.7	.7	.6	.5	(¹)	.6	.6	.6	.5	.5	.5
Nonferrous metals and products ³	333-36	(¹)	.6	.9	.9	.9	.9	.9	1.0	.9	.8	(¹)	1.1	1.1	.9	.8	.7	.7
Fabricated metal products.....	34	1.1	1.1	1.4	1.2	1.2	1.2	1.1	1.1	1.1	1.2	1.1	1.1	1.1	1.1	1.0	1.0	1.2
Machinery.....	35	2.0	2.1	3.1	3.2	3.1	3.2	3.4	3.3	3.5	3.8	3.8	4.0	4.2	4.4	4.4	4.4	4.8
Office, computing, and accounting machines.....	357	(⁴)	(⁴)	(⁴)	(⁴)	(⁴)	(⁴)	(⁴)	(⁴)	(¹)	(¹)	(¹)	9.4	9.1	9.5	9.6	9.8	10.0
Other machinery, except electrical.....	351-56,358-59	(⁴)	(⁴)	(⁴)	(⁴)	(⁴)	(⁴)	(⁴)	(⁴)	(⁴)	(⁴)	(⁴)	(⁴)	(⁴)	(⁴)	2.1	2.1	2.3
Electrical equipment.....	36	2.6	3.3	3.6	3.5	3.6	3.5	3.4	3.5	3.5	3.5	3.5	3.6	3.7	3.4	3.6	3.6	3.9
Radio and TV receiving equipment.....	365	(⁴)	(⁴)	(⁴)	(¹)	(¹)	(¹)	(¹)	(¹)	(¹)	(¹)	(¹)	1.4	1.4	1.4	1.1	1.2	1.6
Communication equipment.....	366	(¹)	3.3	4.2	3.9	4.3	4.0	3.7	3.8	3.9	3.9	3.9	4.2	4.3	4.4	4.5	4.8	5.2
Electronic components.....	367	(¹)	3.3	3.0	(¹)	(¹)	(¹)	(¹)	(¹)	3.7	3.9	3.9	(¹)	(¹)	(¹)	(¹)	(¹)	(¹)
Other electrical equipment.....	361-64,369	(¹)	3.3	3.0	(¹)	(¹)	(¹)	(¹)	(¹)	(¹)	(¹)	(¹)	(¹)	(¹)	(¹)	(¹)	(¹)	(¹)
Motor vehicles and motor vehicles equipment.....	371	2.1	2.8	2.5	2.5	2.4	2.6	2.8	2.5	2.8	2.9	3.2	3.0	2.7	2.7	2.9	3.2	4.3
Other transportation equipment.....	373-75,379	(¹)	2.6	2.6	4.0	4.1	4.6	3.8	3.4	3.3	3.0	3.5	2.8	2.8	2.8	3.0	3.2	3.3
Aircraft and missiles.....	372,376	2.0	2.3	2.6	4.0	4.1	4.6	3.8	3.4	3.3	3.0	3.5	2.8	2.8	2.8	3.0	3.2	3.3
Professional and scientific instruments.....	38	3.9	4.1	4.2	3.5	4.2	4.4	4.2	4.5	4.8	5.1	5.2	5.1	5.4	5.4	5.5	5.5	5.6
Scientific and mechanical measuring instruments.....	381-82	4.0	4.0	3.1	2.5	2.9	2.8	2.9	3.3	3.8	4.0	4.4	4.7	5.3	5.5	5.5	5.4	5.7
Optical, surgical, photographic, and other instruments.....	381-87	3.8	4.1	4.8	3.9	4.7	5.0	4.7	4.9	5.1	5.5	5.5	5.2	5.5	5.3	5.5	5.6	5.6
Other manufacturing industries.....	21,27,31,39	(¹)	(¹)	.6	(¹)	(¹)	.7	.8	(¹)	(¹)	(¹)	(¹)	.7	.7	.7	.7	.7	.8
DISTRIBUTION BY SIZE OF COMPANY (BASED ON NUMBER OF EMPLOYEES)																		
Less than 1,000.....		1.4	.7	1.5	1.6	(¹)	(¹)	1.6	1.5	1.5	1.5	1.6	1.4	1.5	1.5	1.4	1.5	1.6
1,000 to 4,999.....		1.2	1.3	1.5	1.4	(¹)	(¹)	1.3	1.3	1.3	1.3	1.2	1.2	1.2	1.4	1.4	1.4	1.5
5,000 to 9,999.....				1.6	1.6	1.6	1.7	1.8	1.8	1.5	1.5	1.4	1.5	1.6	1.5	1.5	1.2	1.2
10,000 to 24,999.....		1.6	1.9	2.1	2.3	2.3	2.4	2.4	2.3	1.4	1.3	1.3	1.5	1.4	1.4	1.4	1.6	1.7
25,000 or more.....										2.5	2.5	2.4	2.6	2.5	2.5	2.5	2.6	2.7

¹Not separately available but included in total.²Data included in the other manufacturing industries group.³SIC codes 3398 and 3399 included in the nonferrous metals and products group for 1957-63.⁴Data not tabulated at this level prior to 1972.⁵Data not tabulated at this level prior to 1977.⁶Included in other electrical equipment group.⁷Estimated by the National Science Foundation.

SOURCE: National Science Foundation.

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Table B-21. R&D funds as a percent of net sales in R&D-performing manufacturing companies ranked by size of R&D program by industry: 1980

Industry	SIC code	First 4 companies	Next 4 companies	Next 12 companies
Total.....		8.7	13.7	7.0
Food and kindred products.....	20	1.0	.8	.4
Textiles and apparel.....	22,23	.7	.5	.4
Lumber, wood products, and furniture.....	24,25	1.4	.8	.3
Paper and allied products.....	26	2.9	1.7	.4
Chemicals and allied products.....	28	4.7	4.6	6.2
Industrial chemicals.....	281-82,286	4.7	4.1	2.3
Drugs and medicines.....	283	10.2	6.1	4.5
Other chemicals.....	284-85,287-89	2.8	1.8	2.1
Petroleum refining and related industries.....	29	.8	.6	.3
Rubber products.....	30	4.0	2.4	1.4
Stone, clay, and glass products.....	32	3.7	1.1	.6
Primary metals.....	33	.7	1.1	.5
Ferrous metals and products.....	331-32,3398-99	.6	.6	.5
Nonferrous metals and products.....	333-36	1.4	1.1	.4
Fabricated metal products.....	34	2.4	1.5	1.6
Machinery.....	35	13.1	5.9	5.9
Office, computing, and accounting machines.....	357	15.4	9.3	6.2
Other machinery, except electrical.....	351-56,358-59	4.6	3.0	2.4
Electrical equipment.....	36	9.6	7.3	8.8
Radio and TV receiving equipment.....	365	1.6	1.6	1.6
Communication equipment.....	366	11.9	6.2	5.9
Electronic components.....	367	9.2	12.5	7.5
Other electrical equipment.....	361-64,369	10.5	3.7	2.3
Motor vehicles and motor vehicles equipment.....	371	5.7	2.5	.6
Other transportation equipment.....	373-75,379	3.4	1.4	.2
Aircraft and missiles.....	372,376	20.0	14.3	6.4
Professional and scientific instruments.....	38	7.9	8.6	5.7
Scientific and mechanical measuring instruments..	381-82	9.0	7.5	4.1
Optical, surgical, photographic, and other instruments.....	383-87	7.6	5.8	4.0
Other manufacturing industries.....	21,27,31,39	1.2	.8	1.0

SOURCE: National Science Foundation.

Table B-22. Company R&D funds as a percent of net sales in R&D-performing manufacturing companies ranked by size of net sales by industry: 1980

(Dollars in millions)

Industry	SIC code	Company R&D funds		Net sales		Company R&D funds as a percent of net sales	
		First 8 companies	Next 12 companies	First 8 companies	Next 12 companies	First 8 companies	Next 12 companies
Total.....		\$5,329	\$4,753	\$215,106	\$150,760	2.5	3.2
Food and kindred products.....	20	146	130	35,851	35,525	.4	.4
Textiles and apparel.....	22,23	30	26	11,223	6,655	.3	.4
Lumber, wood products, and furniture.....	24,25	108	27	12,984	3,714	.8	.7
Paper and allied products.....	26	301	128	26,269	12,460	1.1	1.0
Chemicals and allied products.....	28	1,339	645	47,034	26,775	2.8	2.4
Industrial chemicals.....	281-82,286	1,208	492	41,958	18,761	2.9	2.6
Drugs and medicines.....	283	807	699	15,098	9,500	5.3	7.4
Other chemicals.....	284-85,287-89	359	133	18,943	6,066	1.9	2.2
Petroleum refining and related industries.....	29	1,152	233	174,203	77,827	.7	.3
Rubber products.....	30	346	81	18,774	4,734	1.8	1.7
Stone, clay, and glass products.....	32	259	51	16,560	8,070	1.6	.6
Primary metals.....	33	263	182	54,585	26,318	.5	.7
Ferrous metals and products.....	331-32,3398-99	203	75	41,095	12,166	.3	.6
Nonferrous metals and products.....	333-36	188	103	32,831	12,001	.6	.9
Fabricated metal products.....	34	249	83	17,137	8,544	1.5	1.0
Machinery.....	35	3,388	751	40,415	17,819	8.4	4.2
Office, computing, and accounting machines.....	357	3,088	319	28,908	4,686	10.7	6.8
Other machinery, except electrical.....	351-56,358-59	926	175	24,867	11,067	3.7	1.6
Electrical equipment.....	36	3,233	690	70,706	27,602	4.6	2.5
Radio and TV receiving equipment.....	365	(¹)	8	5,221	320	(¹)	2.5
Communication equipment.....	366	2,401	151	45,170	3,825	5.3	3.9
Electronic components.....	367	733	126	10,874	2,664	6.7	4.7
Other electrical equipment.....	361-64,369	(¹)	229	41,313	9,891	(¹)	2.3
Motor vehicles and motor vehicles equipment.....	371	4,140	64	88,599	6,149	4.7	1.0
Other transportation equipment.....	373-75,379	50	21	6,961	1,441	.7	1.5
Aircraft and missiles.....	372,376	1,670	637	45,995	23,516	3.6	2.7
Professional and scientific instruments.....	38	1,524	205	20,581	6,219	7.3	3.3
Scientific and mechanical measuring instruments..	381-82	438	89	6,501	1,973	6.7	4.5
Optical, surgical, photographic, and other instruments.....	383-87	1,233	92	18,760	3,592	6.6	2.6
Other manufacturing industries.....	21,27,31,39	155	98	27,029	10,339	.6	.9

¹Not separately available but included in total.

SOURCE: National Science Foundation.

Table B-23. Percent of net sales and employment of R&D-performing companies ranked by size of R&D program: 1972-80

Companies ranked by size of R&D program (based on total R&D funds) ¹	1972	1973	1974	1975	1976	1977	1978	1979	1980
Percent of net sales									
First 4 (1-4).....	10	9	6	6	9	9	9	9	7
Next 4 (5-8).....	3	3	5	5	3	3	3	3	3
Next 12 (9-20).....	6	6	5	6	6	6	6	5	8
Next 20 (21-40).....	7	7	11	10	10	10	10	11	6
Next 60 (41-100).....	16	17	16	16	16	14	14	14	17
Next 100 (101-200).....	14	14	14	12	11	14	14	14	15
Next 200 (201-400).....	15	16	17	15	16	16	17	17	17
Percent of employment									
First 4 (1-4).....	9	8	7	7	8	8	8	9	8
Next 4 (5-8).....	4	4	5	5	4	4	4	4	3
Next 12 (9-20).....	7	7	6	6	7	7	7	7	6
Next 20 (21-40).....	8	8	9	8	9	8	8	8	7
Next 60 (41-100).....	12	12	13	13	13	13	12	12	10
Next 100 (101-200).....	12	12	11	11	11	13	13	13	12
Next 200 (201-400).....	16	16	16	15	16	15	15	16	14

¹Companies were ranked individually for each year; therefore, particular companies comprising the size groups may have changed from year to year.

SOURCE: National Science Foundation

Table B-24. Percent of total and Federal R&D funds and of net sales of R&D-performing companies ranked by size of R&D program by industry: 1980

Industry	SIC code	Percent of total R&D funds			Percent of federal R&D funds			Percent of net sales of all R&D performing companies		
		First 4 companies	Next 4	Next 12	First 4 companies	Next 4	Next 12	First 4 companies	Next 4	Next 12
Total.....		18	12	18	8	25	32	7	3	8
Food and kindred products.....	20	30	15	24	0	0	0	12	8	23
Textiles and apparel.....	22,23	33	14	21	0	0	0	18	10	21
Lumber, wood products, and furniture.....	24,25	66	9	9	0	0	0	35	9	24
Paper and allied products.....	26	63	12	14	100	0	0	24	7	37
Chemicals and allied products.....	28	29	15	27	75	1	17	26	14	15
Industrial chemicals.....	281-82,286	60	23	21	84	15	1	41	22	25
Drugs and medicines.....	283	36	23	34	8	47	45	22	23	46
Other chemicals.....	284-85,287-89	52	12	17	96	0	1	36	13	15
Petroleum refining and related industries.....	29	59	25	14	95	2	3	40	26	28
Rubber products.....	30	69	12	9	95	(1)	4	44	14	15
Stone, clay, and glass products.....	32	56	19	13	96	4	0	19	22	27
Primary metals.....	33	31	15	27	31	3	66	26	8	34
Ferrous metals and products.....	331-32,3398-99	49	20	22	72	0	17	43	18	22
Nonferrous metals and products.....	333-36,3392	42	21	26	26	1	66	22	15	46
Fabricated metal products.....	34	38	15	17	61	(1)	38	21	13	14
Machinery.....	35	58	13	13	92	1	(1)	25	12	13
Office, computing, and accounting machines.....	357	79	12	7	99	1	(1)	63	16	17
Other machinery, except electrical.....	351-56,358-59	47	8	11	11	2	44	25	7	13
Electrical equipment.....	36	55	19	14	65	17	11	33	18	12
Radio and TV receiving equipment.....	365	84	7	9	0	0	0	82	7	8
Communication equipment.....	366	73	17	7	70	21	9	61	24	7
Electronic components.....	367	59	19	14	87	5	5	51	12	11
Other electrical equipment.....	361-64,369	81	5	8	95	3	2	50	6	18
Motor vehicles and motor vehicles equipment.....	371	95	3	1	96	2	2	82	6	9
Other transportation equipment.....	373-75,379	82	12	4	94	6	1	31	20	30
Aircraft and missiles.....	372,376	49	31	16	53	31	14	28	25	28
Professional and scientific instruments.....	38	59	6	11	49	2	17	44	7	11
Scientific and mechanical measuring instruments, Optical, surgical, photographic, and other instruments.....	381-82 383-87	59 78	10 9	13 7	71 74	2 3	23 12	40 60	11 9	15 10
Other manufacturing industries.....	21,27,31,39	46	15	19	79	4	11	20	16	16
Nonmanufacturing industries.....	(07-17,41-67,737, 739,807,891)	29	13	21	25	22	18	12	3	17

Note: All rankings are based on total R&D funds.

(1) Less than .5 percent.

SOURCE: National Science Foundation

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Table B-25. Expenditures for energy research and development by selected industry: 1972-81 (projected)

[Dollars in millions]

Industry	SIC code	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981 (pro- jected)
Total.....		\$750	\$1,009	\$1,339	\$1,774	\$2,073	\$2,599	\$3,026	\$3,795	\$4,366	\$4,753
Food and kindred products.....	20	(¹)	(¹)	(¹)	(¹)	(¹)	(¹)	(¹)	(¹)	5	9
Textiles and apparel.....	22,23	0	0	0	0	1	1	1	2	2	(¹)
Lumber, wood products, and furniture.....	24,25	(¹)	(¹)	(¹)	(¹)	(¹)	(¹)	(¹)	(¹)	4	5
Paper and allied products.....	26	(¹)	(¹)	(¹)	(¹)	(¹)	1	2	3	4	4
Chemicals and allied products.....	28	52	47	71	102	121	151	164	232	277	310
Industrial chemicals.....	281-82,286	47	46	69	100	(¹)	(¹)	(¹)	(¹)	265	297
Drugs and medicines.....	283	(¹)	(¹)	(¹)	(¹)	(¹)	(¹)	(¹)	(¹)	(¹)	(¹)
Other chemicals.....	284-85,287-89	(¹)	(¹)	(¹)	(¹)	(¹)	(¹)	(¹)	(¹)	(¹)	(¹)
Petroleum refining and related industries.....	29	285	310	371	405	440	536	648	776	862	1,097
Rubber products.....	30	(¹)	(¹)	(¹)	(¹)	(¹)	10	12	12	17	32
Stone, clay, and glass products.....	32	(¹)	(¹)	(¹)	(¹)	4	6	7	19	24	30
Primary metals.....	33	10	17	22	27	33	52	49	72	86	91
Ferrous metals and products.....	331-32,3398-99	(¹)	(¹)	(¹)	(¹)	12	19	14	19	20	22
Nonferrous metals and products.....	333-36	(¹)	(¹)	(¹)	(¹)	21	33	35	53	66	69
Fabricated metal products.....	34	(¹)	(¹)	(¹)	(¹)	(¹)	(¹)	(¹)	(¹)	(¹)	(¹)
Machinery.....	35	8	11	16	23	40	60	78	83	104	121
Office, computing, and accounting machines.....	357	(¹)	(¹)	(¹)	(¹)	(¹)	(¹)	(¹)	13	17	13
Other machinery, except electrical.....	351-56,358-59	(¹)	(¹)	(¹)	(¹)	(¹)	(¹)	(¹)	70	87	108
Electrical equipment.....	36	194	318	389	464	585	669	747	912	1,012	1,090
Radio and TV receiving equipment.....	365	0	0	0	0	0	0	0	0	0	0
Communication equipment.....	366	(¹)	(¹)	(¹)	(¹)	(¹)	(¹)	(¹)	(¹)	(¹)	(¹)
Electronic components.....	367	(¹)	(¹)	(¹)	(¹)	(¹)	5	5	13	14	15
Other electrical equipment.....	361-64,369	(¹)	(¹)	(¹)	(¹)	(¹)	(¹)	(¹)	(¹)	(¹)	(¹)
Motor vehicles and motor vehicles equipment.....	371	(¹)	(¹)	(¹)	(¹)	(¹)	(¹)	(¹)	(¹)	(¹)	(¹)
Other transportation equipment.....	373-75,379	(¹)	(¹)	(¹)	(¹)	(¹)	(¹)	(¹)	(¹)	(¹)	(¹)
Aircraft and missiles.....	372,376	65	111	142	134	110	165	283	372	441	394
Professional and scientific instruments.....	38	12	13	14	14	10	13	16	13	16	19
Scientific and mechanical measuring instruments, Optical, surgical, photographic, and other instruments.....	381-82 383-87	(¹) (¹)	(¹) (¹)	(¹) (¹)	(¹) (¹)	(¹) (¹)	9 4	11 5	11 2	11 5	13 6
Other manufacturing industries.....	21,27,31,39	(¹)	(¹)	(¹)	(¹)	(¹)	4	7	7	20	15
Nonmanufacturing industries.....	{07-17,41-67,737, 739,807,891}	76	81	100	98	137	197	247	388	423	454

¹Not separately available but included in total.

SOURCE: National Science Foundation

Table B-26. Company funds for energy research and development by selected industry: 1973-80

[Dollars in millions]

Industry	SIC code	1973	1974	1975	1976	1977	1978	1979	1980
Total.....		\$624	\$857	\$1,152	\$1,319	\$1,648	\$1,833	\$2,299	\$2,697
Textiles and apparel.....	22,23	0	0	0	1	1	1	2	2
Paper and allied products.....	26	(¹)	(¹)	(¹)	(¹)	1	2	3	4
Drugs and medicines.....	283	(¹)	(¹)	(¹)	(¹)	(¹)	(¹)	(¹)	(¹)
Other chemicals.....	284-85,287-89	(¹)	(¹)	(¹)	(¹)	(¹)	(¹)	(¹)	(¹)
Petroleum refining and related industries.....	29	(¹)	(¹)	(¹)	(¹)	469	530	623	715
Primary metals.....	33	(¹)	(¹)	(¹)	(¹)	37	30	48	62
Electrical equipment.....	36	74	96	115	122	174	152	255	251
Radio and TV receiving equipment.....	365	0	0	0	0	0	0	0	0
Other transportation equipment.	373-75,379	(¹)	(¹)	(¹)	(¹)	(¹)	(¹)	(¹)	(¹)
Aircraft and missiles.....	372,376	(¹)	(¹)	(¹)	(¹)	57	68	113	146
Scientific and mechanical measuring instruments.....	381-82	(¹)	(¹)	(¹)	(¹)	9	11	11	11
Other manufacturing industries.	.....	(¹)	(¹)	(¹)	(¹)	(¹)	860	1,048	1,282
Nonmanufacturing industries....	{07-17,41-67,737,739,807,891}	39	48	31	66	82	98	185	216

NOTE: Data not available for 1972.

¹Not separately available but included in total.

SOURCE: National Science Foundation.

Table B-27. Federal funds for energy research and development by selected industry: 1973-80

[Dollars in millions]

Industry	SIC code	1973	1974	1975	1976	1977	1978	1979	1980
Total.....		\$385	\$482	\$622	\$754	\$951	\$1,193	\$1,496	\$1,669
Textiles and apparel.....	22,23	0	0	0	0	(²)	(²)	(²)	(²)
Paper and allied products.....	26	(¹)	(¹)	(¹)	(¹)	0	0	0	0
Drugs and medicines.....	283	(¹)	(¹)	(¹)	(¹)	0	0	0	0
Other chemicals.....	284-85,287-89	(¹)	(¹)	(¹)	(¹)	0	0	0	0
Petroleum refining and related industries.....	29	(¹)	(¹)	(¹)	(¹)	67	118	153	147
Primary metals.....	33	(¹)	(¹)	(¹)	(¹)	15	19	24	24
Electrical equipment.....	36	244	293	349	463	495	595	657	761
Radio and TV receiving equipment.....	365	0	0	0	0	0	0	0	0
Other transportation equipment.	373-75,379	(¹)	(¹)	(¹)	(¹)	0	(¹)	(¹)	(¹)
Aircraft and missiles.....	372,376	(¹)	(¹)	(¹)	(¹)	108	215	259	295
Scientific and mechanical measuring instruments.....	381-82	(¹)	(¹)	(¹)	(¹)	0	0	0	0
Other manufacturing industries.	.....	(¹)	(¹)	(¹)	(¹)	(¹)	164	201	235
Nonmanufacturing industries....	{07-17,41-67,737,739,807,891}	42	52	67	71	115	149	203	207

NOTE: Data not available for 1972.

¹Not separately available but included in total.²Less than \$0.5 million.

SOURCE: National Science Foundation.

Table B-28. Industrial expenditures for energy research and development by selected energy source and source of funds: 1979-80

[Dollars in millions]

Selected energy source	1979			1980		
	Total	Federal	Company	Total	Federal	Company
Total.....	\$3,795	\$1,496	\$2,299	\$4,366	\$1,669	\$2,697
Fossil fuels.....	1,108	286	822	1,271	260	1,011
Oil.....	¹ 581	¹ 29	¹ 552	(³)	(³)	(³)
Gas.....	¹ 118	¹ 4	¹ 114	(³)	(³)	(³)
Shale.....	¹ 25	¹ (²)	¹ (²)	(³)	(³)	(³)
Coal.....	¹ 326	¹ 190	¹ 136	(³)	(³)	(³)
Synthetic fossil fuels.....	¹ 246	¹ 158	¹ 88	(³)	(³)	(³)
Mining.....	¹ 1	¹ 0	¹ 1	(³)	(³)	(³)
Other.....	¹ 79	¹ 32	¹ 47	(³)	(³)	(³)
Other fossil fuels.....	¹ 58	¹ (²)	¹ (²)	(³)	(³)	(³)
Nuclear.....	1,080	904	176	1,195	1,045	150
Fission.....	¹ 951	¹ 777	¹ 174	(³)	(³)	(³)
Fusion.....	¹ 129	¹ 127	¹ 2	(³)	(³)	(³)
All other energy.....	1,607	306	1,301	1,900	364	1,536
Geothermal.....	¹ 155	¹ 30	¹ 125	(³)	(³)	(³)
Solar.....	¹ 334	¹ 78	¹ 256	(³)	(³)	(³)
Conservation and utilization.....	¹ 715	¹ 6	¹ 709	(³)	(³)	(³)
All other sources.....	¹ 403	¹ 192	¹ 211	(³)	(³)	(³)

¹Detailed data for 1979 were estimated based upon (a) data actually reported in that year, and (b) revised data for that year which were reported on the 1980 survey form.

²Not separately available but included in total.

³Data not collected.

SOURCE: National Science Foundation.

Table B-29. Industrial expenditures for energy research and development by primary energy source: 1972-81 (projected)

[Dollars in millions]

Primary energy source	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981 (projected)
Total.....	\$750	\$1,009	\$1,339	\$1,774	\$2,073	\$2,599	\$3,026	\$3,795	\$4,366	\$4,753
Fossil fuels.....	(¹)	438	516	550	605	765	860	1,108	1,271	1,520
Oil.....	(¹)	297	329	333	381	² 454	(¹)	² 581	(¹)	(¹)
Gas.....	(¹)	51	74	66	68	² 94	(¹)	² 118	(¹)	(¹)
Shale.....	(¹)	12	18	19	24	² 35	(¹)	² 25	(¹)	(¹)
Coal.....	(¹)	49	65	109	127	² 177	(¹)	² 326	(¹)	(¹)
Synthetic fossil fuels.....	(¹)	(¹)	21	50	74	² 116	(¹)	² 246	(¹)	(¹)
Mining.....	(¹)	(¹)	5	9	10	² 9	(¹)	² 1	(¹)	(¹)
Other.....	(¹)	(¹)	39	50	43	² 52	(¹)	² 79	(¹)	(¹)
Other fossil fuels.....	(¹)	29	30	23	5	² 5	(¹)	² 58	(¹)	(¹)
Nuclear.....	(¹)	501	601	700	799	935	1,016	1,080	1,195	1,243
Fission.....	(¹)	476	567	659	741	² 852	(¹)	² 951	(¹)	(¹)
Fusion.....	(¹)	25	34	41	58	² 83	(¹)	² 129	(¹)	(¹)
All other energy.....	(¹)	70	222	524	669	899	1,150	1,607	1,900	1,990
Geothermal.....	(¹)	1	2	6	13	² 24	(¹)	² 155	(¹)	(¹)
Solar.....	(¹)	2	7	19	43	² 65	(¹)	² 334	(¹)	(¹)
Conservation and utilization.....	(¹)	(¹)	137	435	528	² 694	(¹)	² 715	(¹)	(¹)
All other sources.....	(¹)	67	76	64	85	² 116	(¹)	² 403	(¹)	(¹)

¹Data not collected.

²Detailed data for 1977 and 1979 were estimated based upon (a) data actually reported in those years, and (b) revised data for those years which were reported on the 1978 and 1980 survey forms.

SOURCE: National Science Foundation

Table B-30. Company funds for energy research and development by primary energy source: 1972-80
[Dollars in millions]

Primary energy source	1972	1973	1974	1975	1976	1977	1978	1979	1980
Total	(¹)	\$624	\$857	\$1,152	\$1,316	\$1,648	\$1,833	\$2,299	\$2,697
Fossil fuels	(¹)	² 428	² 503	² 507	² 523	651	692	822	1,011
Oil	(¹)	295	² 326	² 327	² 369	⁴ 436	(¹)	⁴ 552	(¹)
Gas	(¹)	(²)	(²)	(²)	52	⁴ 70	(¹)	⁴ 114	(¹)
Shale	(¹)	² 12	(²)	(²)	(²)	⁴ (²)	(¹)	⁴ (²)	(¹)
Coal	(¹)	42	56	77	80	⁴ 90	(¹)	⁴ 136	(¹)
Synthetic fossil fuels	(¹)	(¹)	(²)	(²)	48	⁴ 58	(¹)	⁴ 88	(¹)
Mining	(¹)	(¹)	(²)	(²)	7	⁴ 5	(¹)	⁴ 1	(¹)
Other	(¹)	(¹)	33	34	25	⁴ 27	(¹)	⁴ 47	(¹)
Other fossil fuels	(¹)	(²)	(²)	(²)	(²)	⁴ (²)	(¹)	⁴ (²)	(¹)
Nuclear	(¹)	135	157	160	198	² 19	222	176	150
Fission	(¹)	127	² 146	156	194	⁴ 213	(¹)	⁴ 174	(¹)
Fusion	(¹)	7	11	4	4	⁴ 6	(¹)	⁴ 2	(¹)
All other energy	(¹)	(²)	(²)	(²)	595	778	919	1,301	1,536
Geothermal	(¹)	(²)	(²)	(²)	5	⁴ 9	(¹)	⁴ 125	(¹)
Solar	(¹)	(²)	(²)	(²)	17	⁴ 22	(¹)	⁴ 256	(¹)
Conservation and utilization	(¹)	(¹)	² 129	² 425	² 511	⁴ 663	(¹)	⁴ 709	(¹)
All other sources	(¹)	59	62	46	62	⁴ 84	(¹)	⁴ 211	(¹)

Data not collected

Revised by the National Science Foundation

Not separately available but included in total

¹ Detailed data for 1977 and 1979 were estimated based upon (a) data actually reported in those years; and (b) revised totals for those years which were reported on the 1978 and 1980 survey forms

SOURCE: National Science Foundation

Table B-31. Federal funds for energy research and development by primary energy source: 1972-80
[Dollars in millions]

Primary energy source	1972	1973	1974	1975	1976	1977	1978	1979	1980
Total	(¹)	\$385	\$482	\$622	\$757	\$951	\$1,193	\$1,496	\$1,669
Fossil fuels	(¹)	10	13	³ 43	³ 82	114	168	286	260
Oil	(¹)	2	3	6	12	⁴ 18	(¹)	⁴ 29	(¹)
Gas	(¹)	(²)	(²)	(²)	16	⁴ 24	(¹)	⁴ 4	(¹)
Shale	(¹)	0	(²)	(²)	(²)	⁴ (²)	(¹)	⁴ (²)	(¹)
Coal	(¹)	7	9	32	47	⁴ 87	(¹)	⁴ 190	(¹)
Synthetic fossil fuels	(¹)	(¹)	(²)	(²)	26	⁴ 58	(¹)	⁴ 158	(¹)
Mining	(¹)	(¹)	(²)	(²)	3	⁴ 84	(¹)	⁴ 0	(¹)
Other	(¹)	(¹)	6	16	18	⁴ 25	(¹)	⁴ 32	(¹)
Other fossil fuels	(¹)	(²)	(²)	(²)	(²)	⁴ (²)	(¹)	⁴ (²)	(¹)
Nuclear	(¹)	366	444	540	601	716	794	904	1,045
Fission	(¹)	349	421	503	547	⁴ 639	(¹)	⁴ 777	(¹)
Fusion	(¹)	18	23	37	54	⁴ 77	(¹)	⁴ 127	(¹)
All other energy	(¹)	(²)	(²)	(²)	74	121	231	306	364
Geothermal	(¹)	(²)	(²)	(²)	8	⁴ 15	(¹)	⁴ 30	(¹)
Solar	(¹)	(²)	(²)	(²)	26	⁴ 43	(¹)	⁴ 78	(¹)
Conservation and utilization	(¹)	(¹)	8	10	17	⁴ 31	(¹)	⁴ 6	(¹)
All other sources	(¹)	8	14	18	23	⁴ 32	(¹)	⁴ 192	(¹)

Data not collected

Not separately available but included in total

Revised by the National Science Foundation

¹ Detailed data for 1977 and 1979 were estimated based upon (a) data actually reported in those years; and (b) revised totals for those years which were reported on the 1978 and 1980 survey forms

SOURCE: National Science Foundation

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Table B-32. Expenditures for pollution abatement research and development by industry: 1973-81 (projected)

[Dollars in millions]

Industry	SIC code	1973	1974	1975	1976	1977	1978	1979	1980	1981 (projected)
Total.....		\$603	\$657	\$647	\$754	\$901	\$1,054	\$1,237	\$1,183	\$1,209
Food and kindred products.....	20	4	3	3	3	3	2	3	4	3
Textiles and apparel.....	22,23	(¹)	(¹)	(¹)	(¹)	(¹)	(¹)	(¹)	(¹)	(¹)
Lumber, wood products, and furniture.....	24,25	3	5	4	4	5	4	4	6	6
Paper and allied products.....	26	1	4	5	6	6	8	(¹)	(¹)	(¹)
Chemicals and allied products.....	28	51	61	71	72	83	81	149	184	201
Industrial chemicals.....	281-82,286	38	39	56	58	65	68	132	164	179
Drugs and medicines.....	283	(¹)	(¹)	(¹)	(¹)	(¹)	(¹)	4	5	5
Other chemicals.....	284-85,287-89	(¹)	(¹)	(¹)	(¹)	(¹)	(¹)	13	15	17
Petroleum refining and related industries.....	29	51	61	65	58	61	72	82	98	105
Rubber products.....	30	0	0	2	2	2	3	3	3	(¹)
Stone, clay, and glass products.....	32	4	7	5	4	6	7	9	11	11
Primary metals.....	33	9	13	24	31	30	26	31	32	34
Ferrous metals and products.....	331-32,3398-99	8	11	17	19	18	13	14	14	16
Nonferrous metals and products.....	333-36	1	3	7	12	12	13	17	18	19
Fabricated metal products.....	34	(¹)	(¹)	(¹)	(¹)	(¹)	(¹)	6	7	9
Machinery.....	35	14	25	23	29	33	41	35	35	42
Office, computing, and accounting machines.....	357	0	0	0	0	0	0	0	0	(¹)
Other machinery, except electrical.....	351-56,358-59	14	25	23	29	33	41	35	35	(¹)
Electrical equipment.....	36	13	16	19	18	20	19	34	39	39
Radio and TV receiving equipment.....	365	0	0	0	0	0	0	0	0	0
Communication equipment.....	366	(¹)	(¹)	(¹)	5	6	6	6	7	(¹)
Electronic components.....	367	0	(¹)	(¹)	(¹)	(¹)	(¹)	(¹)	(¹)	(¹)
Other electrical equipment.....	361-64,369	(¹)	(¹)	(¹)	(¹)	(¹)	(¹)	(¹)	(¹)	(¹)
Motor vehicles and motor vehicles equipment.....	371	380	384	347	413	487	593	(¹)	(¹)	(¹)
Other transportation equipment.....	373-75,379	(¹)	(¹)	(¹)	(¹)	(¹)	(¹)	0	0	0
Aircraft and missiles.....	372,376	29	38	36	48	57	64	64	38	26
Professional and scientific instruments.....	38	(¹)	(¹)	(¹)	(¹)	3	4	3	3	3
Scientific and mechanical measuring instruments.....	381-82	(¹)	(¹)	(¹)	(¹)	(¹)	(¹)	(¹)	(¹)	(¹)
Optical, surgical, photographic, and other instruments.....	383-87	(¹)	(¹)	(¹)	(¹)	(¹)	(¹)	(¹)	(¹)	(¹)
Other manufacturing industries.....	21,27,31,39	2	2	1	2	3	3	3	4	3
Nonmanufacturing industries.....	{ 07-17,41-67,737, 739,807,891 }	36	29	34	55	93	119	115	101	101

¹Not separately available but included in total.

SOURCE: National Science Foundation.

Table B-33. Expenditures for pollution abatement research and development by industry and source of funds: 1979-80

[Dollars in millions]

Industry	SIC code	1979			1980		
		Total	Federal	Company	Total	Federal	Company
Total.....		\$1,237	\$98	\$1,139	\$1,183	\$117	\$1,066
Food and kindred products.....	20	3	0	3	4	0	4
Textiles and apparel.....	22,23	(¹)	0	(¹)	(¹)	0	2
Lumber, wood products, and furniture.....	24,25	4	0	4	6	0	6
Paper and allied products.....	26	(¹)	0	(¹)	(¹)	0	(¹)
Chemicals and allied products.....	28	149	36	113	184	58	126
Industrial chemicals.....	281-82,286	132	36	96	164	58	106
Drugs and medicines.....	283	4	0	4	5	0	5
Other chemicals.....	284-85,287-89	13	0	13	15	0	15
Petroleum refining and related industries.....	29	82	(¹)	(¹)	98	(¹)	(¹)
Rubber products.....	30	3	(¹)	(¹)	3	(¹)	(¹)
Stone, clay, and glass products.....	32	9	0	9	11	0	11
Primary metals.....	33	31	(¹)	(¹)	32	0	32
Ferrous metals and products.....	331-32,3398-99	14	(¹)	(¹)	14	0	14
Nonferrous metals and products.....	333-36	17	0	17	18	0	18
Fabricated metal products.....	34	6	(¹)	(¹)	7	0	7
Machinery.....	35	35	(¹)	(¹)	35	(¹)	(¹)
Office, computing, and accounting machines.....	357	0	0	0	0	0	(¹)
Other machinery, except electrical.....	351-56,358-59	35	(¹)	(¹)	35	(¹)	(¹)
Electrical equipment.....	36	34	17	17	39	22	17
Radio and TV receiving equipment.....	365	0	0	0	0	0	0
Communication equipment.....	366	6	(¹)	(¹)	7	7	(¹)
Electronic components.....	367	(¹)	0	(¹)	(¹)	(¹)	0
Other electrical equipment.....	361-64,369	(¹)	(¹)	(¹)	(¹)	(¹)	(¹)
Motor vehicles and motor vehicles equipment.....	371	(¹)	(¹)	(¹)	(¹)	(¹)	(¹)
Other transportation equipment.....	373-75,379	0	0	0	0	0	0
Aircraft and missiles.....	372,376	64	(¹)	(¹)	38	(¹)	(¹)
Professional and scientific instruments.....	38	3	0	3	3	0	3
Scientific and mechanical measuring instruments.....	381-82	(¹)	0	(¹)	(¹)	0	(¹)
Optical, surgical, photographic, and other instruments.....	383-87	(¹)	0	(¹)	(¹)	0	(¹)
Other manufacturing industries.....	21,27,31,39	3	0	3	4	0	4
Nonmanufacturing industries.....	{ 07-17,41-67, 737,739,807,891 }	113	15	98	101	18	83

¹Not separately available but included in total.

SOURCE: National Science Foundation.

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Table B-34. Industrial expenditures for pollution abatement research and development by type of pollution and source of funds: 1979-80

[Dollars in millions]

Type of pollution	1979			1980		
	Total	Federal	Company	Total	Federal	Company
Total.....	\$1,237	\$98	\$1,139	\$1,183	\$117	\$1,066
Air.....	¹ 954	¹ 30	¹ 924	(²)	(²)	(²)
Automotive emission.....	¹ 736	¹ 6	¹ 730	(²)	(²)	(²)
Electric power plant emissions.....	¹ 70	¹ 8	¹ 62	(²)	(²)	(²)
All other.....	¹ 148	¹ 16	¹ 132	(²)	(²)	(²)
Water.....	¹ 120	¹ 13	¹ 107	(²)	(²)	(²)
Solid waste.....	¹ 44	¹ 32	¹ 12	(²)	(²)	(²)
Other.....	¹ 120	¹ 22	¹ 98	(²)	(²)	(²)

¹Detailed data for 1979 were estimated based upon (a) data actually reported in that year, and (b) a revised total for that year which was reported on the 1980 survey form.

²Data not collected.

SOURCE: National Science Foundation.

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Table B-35. Industrial expenditures for pollution abatement research and development by type of pollution:
1973-81 (projected)

[Dollars in millions]

Type of pollution	1973	1974	1975	1976	1977	1978	1979	1980	1981 (projected)
Total.....	\$603	\$657	\$647	\$754	\$901	\$1,054	\$1,237	\$1,183	\$1,209
Air.....	461	508	478	569	² 676	(¹)	² 954	(¹)	(¹)
Automotive emission.....	(¹)	383	348	426	² 495	(¹)	² 736	(¹)	(¹)
Electric power plant emissions..	(¹)	25	28	31	² 67	(¹)	² 70	(¹)	(¹)
All other.....	(¹)	100	102	112	² 114	(¹)	² 148	(¹)	(¹)
Water.....	76	60	71	84	² 97	(¹)	² 120	(¹)	(¹)
Solid waste.....	10	14	23	21	² 28	(¹)	² 44	(¹)	(¹)
Other.....	56	75	75	80	² 100	(¹)	² 120	(¹)	(¹)

¹Data not collected.²Detailed data for 1977 and 1979 were estimated based upon (a) data actually reported in those years, and (b) revised totals for those years which were reported on the 1978 and 1980 survey forms.

SOURCE: National Science Foundation.

Table B-36. Full-time-equivalent number of R&D scientists and engineers by industry and size of company: 1957-58, 1963-64, 1967-68 and 1970-81

		In thousands																		
Industry and size of company		SIC code	January																	
			1957	1958	1963	1964	1967	1968	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981
Total.....			229.4	234.8	327.3	340.2	367.2	376.7	384.2	367.0	350.2	357.7	360.0	363.3	364.4	382.9	403.7	423.2	446.6	470.2
DISTRIBUTION BY INDUSTRY																				
Food and kindred products.....		20	3.8	4.8	5.1	5.7	6.1	6.3	6.3	6.6	6.5	6.6	6.4	6.8	6.9	6.9	6.9	7.4	7.2	7.4
Textiles and apparel.....		22,23	.7	.8	1.0	1.2	1.9	2.5	2.9	1.8	1.8	1.9	1.8	1.8	1.8	1.7	1.7	1.7	1.8	1.7
Lumber, wood products, and furniture.....		24,25	.8	.8	.5	.5	.5	.5	1.2	1.8	1.6	1.9	2.1	2.3	2.1	2.1	2.2	2.2	2.2	2.3
Paper and allied products.....		26	1.5	1.7	2.5	3.8	4.7	4.8	5.0	5.0	4.9	4.9	4.9	5.0	5.2	6.3	6.6	7.2	7.5	8.2
Chemicals and allied products.....		28	29.4	31.0	34.3	35.8	36.9	38.9	40.1	42.7	41.0	40.9	41.8	45.2	46.4	48.4	47.9	49.1	50.0	52.4
Industrial chemicals.....		281-82,286	18.0	18.8	22.9	22.2	21.7	22.3	21.5	21.8	19.1	19.1	19.1	21.1	20.1	20.6	21.5	21.6	21.3	22.1
Drugs and medicines.....		283	4.7	5.1	6.9	6.9	8.7	9.8	11.8	12.3	13.1	13.0	14.0	15.6	16.6	17.8	18.9	19.7	20.0	21.1
Other chemicals.....		284-85,287-89	6.7	7.1	8.5	6.7	6.5	6.8	6.8	8.6	8.8	8.8	8.7	8.5	7.8	8.0	7.4	7.8	8.7	9.6
Petroleum refining and related industries.....		29	6.9	7.4	8.9	8.1	8.7	9.2	9.9	9.2	8.3	8.2	8.2	8.4	8.6	8.9	10.0	10.3	11.0	13.4
Rubber products.....		30	4.7	4.7	5.8	6.0	5.8	6.1	7.4	6.7	6.7	7.5	7.7	8.4	8.6	9.1	7.9	8.1	(1)	(1)
Stone, clay, and glass products.....		32	(2)	(2)	3.8	3.3	3.3	4.1	4.6	4.3	4.1	4.2	4.5	4.5	4.6	4.5	5.1	5.2	5.4	(3)
Primary metals.....		33	5.1	5.2	5.2	5.1	5.9	5.9	6.5	6.6	6.4	6.0	6.4	6.3	8.1	8.4	8.1	9.3	8.8	8.5
Ferrous metals and products ⁴		331-32,3398-99	2.9	3.0	2.9	2.8	3.3	3.1	3.2	3.4	3.4	3.2	3.3	3.3	3.9	3.9	3.7	3.8	4.0	3.6
Nonferrous metals and products.....		333-36	2.2	2.2	2.3	2.3	2.5	2.7	3.3	3.2	3.0	2.8	3.1	3.0	4.2	4.5	4.4	4.5	4.8	4.9
Fabricated metal products.....		34	8.4	8.3	6.8	7.0	6.3	5.6	5.9	7.1	6.8	6.7	7.3	7.4	6.8	7.1	7.3	7.4	8.9	9.3
Machinery.....		35	24.9	27.4	31.4	27.3	33.6	37.4	42.1	37.7	43.7	46.3	51.0	52.8	55.7	55.3	54.2	61.5	63.8	65.2
Office, computing, and accounting machines.....		357	(4)	(4)	(4)	(4)	(4)	(4)	(4)	(4)	(4)	(4)	30.1	34.5	36.1	38.1	37.7	39.3	42.2	45.5
Other machinery, except electrical.....		351-56,358-59	(4)	(4)	(4)	(4)	(4)	(4)	(4)	(4)	(4)	(4)	(4)	(4)	(4)	(4)	14.9	19.3	20.3	19.1
Electrical equipment.....		36	42.9	47.9	85.8	89.5	98.6	98.4	100.6	91.8	83.6	85.4	82.6	82.6	80.1	84.1	85.7	87.7	97.4	105.9
Radio and TV receiving equipment.....		363	(4)	(4)	(4)	(4)	.9	1.0	1.9	2.4	2.1	1.4	1.3	1.0	1.1	.9	.9	.9	.9	1.1
Communication equipment.....		366	19.2	22.3	55.1	60.4	66.7	67.4	66.8	60.3	53.2	45.3	42.0	40.2	37.4	38.0	40.6	41.4	47.1	51.2
Electronic components.....		367										9.4	9.6	10.6	10.2	13.0	14.2	14.0	14.1	(4)
Other electrical equipment.....		361-64,369	23.7	25.6	30.7	29.1	31.0	30.0	33.9	29.1	28.3	29.3	29.7	30.8	31.6	32.2	30.0	29.4	31.3	33.7
Motor vehicles and motor vehicles equipment.....		371	13.6	15.0	21.1	23.3	25.2	24.3	25.5	28.2	29.7	28.2	27.4	26.0	25.4	28.2	30.7	32.9	34.4	36.4
Other transportation equipment.....		373-75,379	58.7	58.6	90.7	101.1	100.4	101.1	92.2	78.2	70.8	72.1	70.6	67.5	66.9	72.0	82.0	86.5	96.8	96.1
Aircraft and missiles.....		372,376	10.2	11.0	9.4	10.8	13.0	14.1	15.0	15.1	15.2	16.3	17.5	17.9	18.8	20.5	22.2	24.3	27.3	27.1
Professional and scientific instruments.....		38	5.8	6.5	3.9	3.8	3.6	3.8	4.1	4.6	4.7	5.3	5.6	5.9	6.7	7.2	7.9	9.0	(1)	11.0
Scientific and mechanical measuring instruments.....		381-82	4.4	4.5	5.5	7.0	9.4	10.3	10.9	10.5	10.5	11.0	11.9	12.0	12.1	13.3	14.3	15.3	16.3	16.0
Optical, surgical, photographic, and other instruments.....		383-87																		
Other manufacturing industries.....		21,27,31,39	17.8	19.2	2.8	2.0	2.2	2.4	2.6	3.8	3.6	3.6	3.7	3.7	4.2	4.5	4.6	4.8	4.7	5.0
Nonmanufacturing industries.....		07-17,41-67,737,739,807,891	8.2	9.8	14.1	15.1	16.3	15.6	15.7	15.3	14.4	14.9	14.6	15.3	14.7	16.6	18.9	20.9		
DISTRIBUTION BY SIZE OF COMPANY (BASED ON NUMBER OF EMPLOYEES)																				
Less than 1,000.....			44.8	48.8	34.1	32.5	27.4	27.2	(1)	28.2	28.4	29.0	28.0	30.1	30.2	31.1	29.4	28.3	30.6	31.4
1,000 to 4,999.....			22.4	24.0	35.0	34.5	30.5	29.9	(1)	31.8	30.9	28.9	28.8	29.9	29.3	28.9	28.0	32.6	39.2	41.0
5,000 to 9,999.....							24.0	24.6	28.5	28.7	28.4	27.0	26.4	27.4	26.1	28.6	31.9	37.7	39.3	39.9
10,000 to 24,999.....			162.2	171.0	258.2	273.2						45.1	45.9	47.4	50.6	49.3	51.6	54.0	63.1	65.2
25,000 or more.....							285.3	295.0	299.1	278.3	262.5	227.7	230.9	228.5	228.2	244.9	263.9	273.6	274.4	292.7

¹Not separately available but included in total.²Data included in the other manufacturing industries group.³SIC codes 3398 and 3399 included in the nonferrous metals and products group for January 1957-64.⁴Data not tabulated at this level prior to the 1972 survey.⁵Data not tabulated at this level prior to the 1977 survey.⁶Included in the other electrical equipment group.

SOURCE: National Science Foundation.

BEST DOCUMENT AVAILABLE

Table B-37. Cost per R & D scientist or engineer by industry and size of company: 1957-58, 1963, 1967, and 1969-80

Industry and size of company	SIC code	1957	1958	1963	1967	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980
Total.....		\$32,700	\$33,800	\$37,800	\$44,100	\$47,500	\$48,100	\$51,100	\$55,300	\$59,200	\$63,300	\$66,500	\$72,200	\$76,100	\$80,700	\$87,700	\$95,700
DISTRIBUTION BY INDUSTRY																	
Food and kindred products.....	20	17,200	16,800	25,200	29,500	32,100	35,400	36,600	39,500	41,400	45,200	48,900	51,400	57,200	60,000	62,900	70,800
Textiles and apparel.....	22, 23	20,000	28,900	26,400	25,900	25,500	24,700	32,800	32,100	34,900	38,300	38,900	46,900	46,300	49,400	53,100	58,300
Lumber, wood products, and furniture.....	24, 25	17,500	13,300	22,000	24,000	16,400	34,700	29,400	33,700	35,500	38,200	40,000	51,000	59,100	60,500	68,600	73,300
Paper and allied products.....	26	21,900	22,700	27,000	26,900	38,800	36,000	37,800	38,600	38,900	47,900	48,800	54,400	56,900	56,700	61,800	64,700
Chemicals and allied products.....	28	23,300	24,600	32,600	39,800	41,400	42,800	43,700	47,100	51,100	56,300	60,900	66,500	69,100	73,900	81,400	89,600
Industrial chemicals.....	281-82, 288	27,400	28,400	34,800	43,900	46,000	47,500	49,200	54,000	58,600	63,500	67,500	74,700	80,000	85,200	94,300	104,700
Drugs and medicines.....	283	21,200	23,300	30,200	37,100	40,400	40,100	43,200	46,500	51,500	54,300	60,900	63,400	65,000	65,800	72,800	81,000
Other chemicals.....	284-85, 287-89	14,200	15,300	27,900	29,800	29,100	33,400	35,500	33,400	34,000	45,300	43,200	50,800	54,200	63,000	68,500	73,200
Petroleum refining and related industries.....	29	29,500	32,600	35,400	41,500	46,900	53,900	57,700	57,100	60,400	74,900	81,500	87,200	97,100	104,400	119,700	128,300
Rubber products.....	30	22,800	18,700	26,500	30,600	37,300	38,900	43,100	53,100	56,100	58,300	54,900	56,700	57,800	61,000	(¹)	(¹)
Stone, clay, and glass products.....	32	(²)	(²)	26,000	36,800	36,100	37,100	39,000	43,600	45,200	48,200	51,200	57,800	59,800	62,300	66,400	(¹)
Primary metals.....	33	21,000	24,000	35,700	41,000	40,200	41,700	41,800	44,700	49,500	55,900	61,500	61,300	64,700	67,000	71,700	80,100
Ferrous metals and products ³	331-32, 3398-99	21,700	24,600	37,400	42,200	42,500	45,200	42,400	44,200	50,200	54,800	59,700	65,600	68,700	71,000	75,100	83,700
Nonferrous metals and products ³	333-36	20,000	23,200	33,500	41,200	37,800	38,200	41,300	44,800	48,300	57,100	63,300	57,500	61,200	63,600	68,800	77,300
Fabricated metal products.....	34	16,200	18,800	22,200	27,400	28,900	31,800	35,100	37,800	41,600	42,300	45,600	51,500	54,700	53,900	58,800	64,600
Machinery.....	35	25,600	27,500	31,000	37,400	37,600	40,700	43,100	48,000	52,400	57,500	58,900	62,800	69,900	74,900	81,900	94,200
Office, computing, and accounting machines.....	357	(⁴)	(⁴)	(⁴)	(⁴)	(⁴)	(⁴)	(⁴)	48,500	53,700	59,600	59,800	63,400	71,800	76,900	84,300	95,700
Other machinery, except electrical.....	351-36, 358-59	(⁵)	(⁵)	(⁵)	(⁵)	(⁵)	(⁵)	(⁵)	(⁵)	(⁵)	(⁵)	(⁵)	(⁵)	65,600	70,500	76,800	90,800
Electrical equipment.....	36	39,700	38,200	33,000	39,300	43,300	43,900	50,100	55,400	58,400	60,700	62,700	68,600	69,900	76,300	85,700	89,900
Radio and TV receiving equipment.....	365	(⁶)	(⁶)	(⁶)	47,400	36,800	32,600	28,400	26,700	37,500	44,300	47,600	52,000	51,000	61,200	72,900	89,000
Communication equipment.....	366	36,000	34,600	31,700	36,200	40,700	41,600	48,200	57,800	59,800	59,000	61,300	66,100	71,500	76,000	87,300	91,800
Electronic components.....	367	42,800	41,900	35,400	45,800	48,500	49,100	55,300	59,700	62,200	67,700	68,000	74,700	74,500	85,100	94,300	98,000
Other electrical equipment.....	361-64, 368	42,800	41,900	35,400	45,800	48,500	49,100	55,300	59,700	62,200	67,700	68,000	74,700	74,500	85,100	94,300	98,000
Motor vehicles and motor vehicles equipment.....	371	49,400	53,800	49,400	54,700	61,700	59,600	58,900	68,100	86,500	89,500	91,100	103,700	112,900	120,800	131,400	149,500
Other transportation equipment.....	373-75, 379	43,900	41,900	49,600	56,300	61,300	61,300	65,500	69,200	70,800	76,400	85,100	91,300	92,300	91,300	88,000	106,900
Aircraft and missiles.....	372, 376	23,500	25,600	29,900	40,000	48,800	49,300	49,100	53,200	56,900	60,700	63,900	66,700	69,500	75,600	79,600	83,500
Professional and scientific instruments.....	38	23,500	25,600	29,900	40,000	48,800	49,300	49,100	53,200	56,900	60,700	63,900	66,700	69,500	75,600	79,600	83,500
Scientific and mechanical measuring instruments.....	381-82	23,600	23,100	18,400	28,100	30,000	29,800	28,300	32,600	34,100	38,400	42,200	46,800	51,700	58,300	(¹)	(¹)
Optical, radiological, photographic, and other instruments.....	383-87	24,700	29,100	37,500	44,500	56,300	57,300	58,300	62,800	67,700	71,500	75,300	77,900	79,500	85,500	92,000	95,000
Other manufacturing industries.....	21, 27, 31, 33	(¹)	(¹)	23,700	39,100	38,500	40,000	35,400	40,600	43,300	47,800	51,900	51,700	54,900	60,200	66,700	84,500
Nonmanufacturing industries.....	80-89, 90-99	39,807, 891	(¹)	31,000	38,300	41,700	44,200	45,000	45,600	49,300	52,400	49,700	56,500	61,400	72,700	77,400	79,000
DISAGGREGATION BY SIZE OF COMPANY (BASED ON NUMBER OF EMPLOYEES)																	
Less than 25 employees.....		11,600	12,000	16,600	25,200	(¹)	(¹)	31,200	32,400	32,900	36,400	40,500	45,200	43,200	47,800	54,800	58,600
25 to 49,999.....		27,200	25,100	29,400	33,700	(¹)	(¹)	38,100	40,600	43,200	46,700	46,800	51,600	55,900	64,900	70,400	69,100
50 to 99,999.....		38,700	38,700	41,400	36,700	38,900	38,300	41,000	38,800	43,700	50,000	55,300	60,300	61,700	46,300	46,100	54,200
100 or more.....		39,400	38,700	41,400	45,800	50,900	51,400	55,700	48,700	49,100	51,800	53,700	57,500	66,900	78,500	84,200	87,000
									63,600	68,700	72,700	76,600	82,700	85,800	90,400	99,600	111,300

NOTE: The number of R & D scientists and engineers derived by using the arithmetic mean of the full-time-equivalent of R & D scientists and engineers employed in the Januaries of two consecutive years.

¹Not separately available but included in total.

²Included in the other manufacturing group.

³SIC codes 3398 and 3399 included in the nonferrous metals and product groups for 1957-63.

⁴Data not tabulated at this level prior to 1962.

⁵Data not tabulated at this level prior to 1977.

⁶Included in other electrical equipment group.

⁷Estimated by the National Science Foundation.

SOURCE: National Science Foundation.

Table B-38. Cost per R&D scientist or engineer¹ by industry and selected company size group: 1980

Industry	SIC code	Companies with total employment of-			
		Total	5,000 to 9,999	10,000 to 24,999	25,000 or more
Total.....		\$95,722	\$54,217	\$87,030	\$111,310
Food and kindred products.....	20	70,822	67,539	67,909	74,057
Textiles and apparel.....	22, 23	58,286	72,985	58,913	50,933
Lumber, wood products, and furniture.....	24, 25	73,333	85,500	(²)	(²)
Paper and allied products.....	26	64,713	(²)	74,921	(²)
Chemicals and allied products.....	28	89,650	54,168	89,110	100,042
Industrial chemicals.....	281-82, 286	104,747	79,856	110,018	105,930
Drugs and medicines.....	283	81,022	33,845	88,160	73,608
Other chemicals.....	284-85, 287-89	73,224	77,025	68,859	(²)
Petroleum refining and related industries.....	29	128,279	(²)	120,339	134,158
Rubber products.....	30	(²)	63,119	(²)	70,300
Stone, clay, and glass products.....	32	(²)	83,471	83,203	(²)
Primary metals.....	33	80,116	51,216	83,563	105,506
Ferrous metals and products.....	331-32, 3398-99	83,684	67,835	62,338	(²)
Nonferrous metals and products.....	333-36	77,320	47,187	90,822	(²)
Fabricated metal products.....	34	64,615	70,526	90,023	77,936
Machinery.....	35	94,202	67,636	66,863	108,038
Office, computing, and accounting machines...	357	95,692	(²)	72,825	101,793
Other machinery, except electrical.....	351-56, 358-59	90,812	79,474	64,565	149,649
Electrical equipment.....	36	89,887	60,448	96,802	91,083
Radio and TV receiving equipment.....	365	89,000	0	(²)	(²)
Communication equipment.....	366	91,760	109,758	(²)	89,066
Electronic components.....	367	(²)	70,427	129,320	(²)
Other electrical equipment.....	361-64, 369	97,969	32,716	71,245	110,781
Motor vehicles and motor vehicles equipment....	371	149,475	88,315	94,716	157,975
Other transportation equipment.....	373-75, 379	106,897	(²)	89,863	29,000
Aircraft and missiles.....	372, 376	105,260	121,528	104,691	105,397
Professional and scientific instruments.....	38	83,456	62,855	61,690	117,396
Scientific and mechanical measuring instruments.....	381-82	(²)	64,053	(²)	(²)
Optical, surgical, photographic, and other instruments.....	383-87	95,046	59,187	(²)	(²)
Other manufacturing industries.....	21, 27, 31, 39	84,536	103,793	92,073	95,041
Nonmanufacturing industries.....	07-17, 41-67, 737, 739, 807, 891	79,043	49,045	104,479	104,816

¹See note on table B-35.²Not separately available but included in total.

SOURCE: National Science Foundation.

Table B-39. Cost per R&D scientist or engineer in companies ranked by size of R&D program: 1972-80

Companies ranked by size of R&D program (based on total R&D funds)	1972	1973	1974	1975	1976	1977	1978	1979	1980
First 4.....	\$64,500	\$68,500	\$80,700	\$90,500	\$102,500	\$105,200	\$109,400	\$121,700	\$140,600
Next 4.....	76,300	81,700	80,500	84,000	87,600	94,600	103,800	105,700	110,900
Next 12.....	63,100	73,200	76,900	80,600	82,900	79,300	83,800	90,500	105,100
Next 20.....	57,500	60,400	62,200	66,400	68,200	75,900	80,800	87,600	103,500
Next 60.....	51,000	52,700	66,200	61,400	65,200	69,900	74,200	80,100	93,000
Next 100.....	41,600	45,400	49,900	52,400	53,400	57,200	58,700	63,400	72,400
Next 200.....	39,700	43,600	44,000	43,600	48,300	54,200	56,900	61,200	70,600
Average of above 400 R&D performing companies.....	57,200	61,100	66,900	70,400	74,300	78,100	82,200	88,500	98,900
Average of the R&D performing companies less above 400.....	28,300	29,100	32,800	40,100	44,000	44,900	46,200	47,400	56,500

Note: The number of R&D scientists and engineers is derived by using the arithmetic mean of the full-time equivalent of R&D scientists and engineers employed in the Januaries of two consecutive years.

SOURCE: National Science Foundation.

Table B-40. Total employment of R&D-performing companies by industry and size of company: 1979-80.

[In thousands]

Industry	SIC code	1979				1980			
		Companies with total employment of-				Companies with total employment of-			
		Total	5,000 to 9,999	10,000 to 24,999	25,000 or more	Total	5,000 to 9,999	10,000 to 24,999	25,000 or more
Total.....		15,549	1,611	3,184	7,553	15,663	1,619	3,223	7,560
Food and kindred products.....	20	958	146	255	383	973	147	268	394
Textiles and apparel.....	22, 23	611	77	236	146	618	77	231	159
Lumber, wood products, and furniture.....	24, 25	336	67	74	1	328	65	74	1
Paper and allied products.....	26	528	33	153	222	532	33	152	226
Chemicals and allied products.....	28	1,224	151	368	500	1,260	151	378	517
Industrial chemicals.....	281-32, 286	593	79	115	348	604	79	113	359
Drugs and medicines.....	283	325	33	145	112	338	32	153	1
Other chemicals.....	284-85, 287-89	306	39	108	40	318	40	112	1
Petroleum refining and related industries....	29	529	1	73	414	583	1	79	463
Rubber products.....	30	445	62	90	173	421	60	80	166
Stone, clay, and glass products.....	32	420	37	169	89	421	38	170	1
Primary metals.....	33	1,118	75	233	623	1,077	79	195	592
Ferrous metals and products.....	331-32, 3398-99	776	41	74	542	741	40	70	513
Nonferrous metals and products.....	333-36	342	34	159	81	336	39	125	1
Fabricated metal products.....	34	669	135	109	174	666	133	106	177
Machinery.....	35	1,649	175	264	691	1,738	177	295	728
Office, computing, and accounting machines.	357	586	30	61	449	628	31	67	485
Other machinery, except electrical.....	351-56, 358-59	1,063	145	203	242	1,110	146	224	243
Electrical equipment.....	36	2,250	134	249	1,486	2,287	134	266	1,494
Radio and TV receiving equipment.....	365	64	0	1	1	62	0	1	1
Communication equipment.....	366	863	36	1	708	896	38	1	712
Electronic components.....	367	306	35	1	1	324	34	1	1
Other electrical equipment.....	361-64, 369	1,017	63	169	609	1,005	62	176	591
Motor vehicles and motor vehicles equipment..	371	1,327	51	94	1,104	1,139	47	87	939
Other transportation equipment.....	373-75, 379	145	1	59	1	146	1	60	1
Aircraft and missiles.....	372, 376	1,039	40	117	833	1,101	42	118	890
Professional and scientific instruments.....	38	572	86	96	205	596	84	106	216
Scientific and mechanical measuring instruments.....	381-82	209	43	43	1	237	43	55	1
Optical, surgical, photographic, and other instruments.....	383-87	363	43	53	1	359	41	51	1
Other manufacturing industries.....	21, 27, 31, 39	798	112	213	226	810	117	213	228
Nonmanufacturing industries.....	{ 07-17, 41-67, 737, 739, 807, 891 }	931	206	332	172	967	211	345	185

¹Not separately available but included in total.

SOURCE: National Science Foundation.

Table B-41. R&D scientists and engineers per 1,000 employees by industry and size of company: 1958, 1963, and 1967-80

Industry and size of company	SIC code	1958	1963	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980
DISTRIBUTION BY INDUSTRY																	
Total.....		21	28	27	26	26	26	26	24	24	25	26	27	27	28	28	29
Food and kindred products.....	20	6	7	7	8	7	7	7	7	7	7	7	7	7	8	8	8
Textiles and apparel.....	22,23	1	3	3	4	4	4	3	3	3	3	3	3	3	3	3	3
Lumber, wood products, and furniture.....	24,25	5	4	4	4	5	6	7	6	7	7	7	7	7	7	7	7
Paper and allied products.....	26	6	6	6	6	6	8	8	8	8	8	10	12	12	14	14	15
Chemicals and allied products.....	28	19	40	36	35	35	39	41	39	39	40	41	40	42	42	40	41
Industrial chemicals.....	281-82,286	42	40	33	32	32	35	35	34	36	37	38	36	38	38	36	36
Drugs and medicines.....	283	46	47	51	48	48	65	65	60	57	57	59	64	62	64	61	61
Other chemicals.....	284-85,287-89	30	38	33	30	31	30	31	31	29	30	29	28	28	26	27	29
Petroleum refining and related industries.....	29	15	17	18	15	16	17	17	16	17	18	19	17	18	20	20	21
Rubber products.....	30	19	20	17	17	17	17	15	16	17	17	18	18	19	18	(1)	(1)
Stone, clay, and glass products.....	32	(1)	12	14	10	10	11	11	10	10	11	11	11	12	13	13	(1)
Primary metals.....	33	5	5	5	5	6	6	5	5	5	5	7	8	8	8	8	8
Ferrous metals and products ²	331-32,3398-99	4	4	4	4	4	4	4	4	4	4	5	5	5	5	5	5
Nonferrous metals and products ²	333-36	6	8	8	8	8	9	8	7	8	7	11	15	14	13	14	14
Fabricated metal products.....	34	16	15	14	12	12	10	11	10	11	11	12	12	12	12	12	14
Machinery.....	35	22	28	28	26	27	28	29	31	31	34	36	38	38	39	38	37
Office, computing, and accounting machines.....	357	(3)	(3)	(3)	(3)	(3)	(3)	(3)	66	65	69	76	79	77	77	73	71
Other machinery, except electrical.....	351-56,358-59	(4)	(4)	(4)	(4)	(4)	(4)	(4)	(4)	(4)	(4)	(4)	(4)	18	19	19	18
Electrical equipment.....	36	43	55	43	45	42	41	38	37	37	37	40	42	41	40	41	44
Radio and TV receiving equipment.....	365	(5)	(5)	18	22	32	32	35	26	20	18	16	15	13	13	13	16
Communication equipment.....	366	52	67	52	58	50	46	43	42	43	43	44	45	46	48	52	55
Electronic components.....	367	52	67	52	58	50	46	43	39	40	40	49	55	54	51	52	(1)
Other electrical equipment.....	361-64,369	37	41	35	33	33	35	32	31	31	32	36	38	34	31	30	32
Motor vehicles and motor vehicles equipment.....	371	16	19	20	19	19	20	22	23	22	24	25	25	24	25	25	28
Other transportation equipment.....	373-75,379	16	19	20	19	19	20	22	14	13	13	13	14	13	14	12	10
Aircraft and missiles.....	372,376	72	99	89	81	80	73	74	76	68	72	72	78	82	89	83	83
Professional and scientific instruments.....	38	44	36	32	37	34	29	33	33	34	35	38	41	42	45	45	46
Scientific and mechanical measuring instruments..	381-82	57	38	26	29	28	27	31	31	33	35	41	45	45	50	(1)	(1)
Optical, surgical, photographic, and other instruments.....	383-87	33	35	35	40	36	32	33	34	35	35	37	38	41	43	44	45
Other manufacturing industries.....	21,27,31,39	(1)	9	6	6	7	6	7	6	6	6	7	8	7	8	6	6
Nonmanufacturing industries.....	07-17,41-67,739,807,891,737	(1)	9	13	12	12	23	22	21	18	17	16	19	18	18	19	21
DISTRIBUTION BY SIZE OF COMPANY (BASED ON NUMBER OF EMPLOYEES)																	
Less than 1,000.....		18	27	28	28	(1)	26	29	28	26	29	26	25	24	24	23	24
1,000 to 4,999.....		12	19	16	16	(1)	18	18	19	17	17	17	17	17	19	19	21
5,000 to 9,999.....		25	31	15	17	17	19	18	19	18	18	17	19	22	19	24	24
10,000 to 24,999.....		25	31	15	17	17	19	18	16	16	16	17	18	19	20	18	20
25,000 or more.....		25	31	31	29	28	29	28	31	31	33	35	34	36	35	36	38

Note: The number of R&D scientists and engineers for 1980 is derived by dividing the arithmetic mean of scientists and engineers employed in January 1980 and January 1981 by the number of company employees in all activities in March 1980. Similar procedures were used in earlier years except 1967-69 in which data were derived by dividing the worker-years of R&D scientists and engineers for the year by the March employment figures.

¹Not separately available but included in total.

²SIC codes 3398 and 3399 included in the nonferrous metals and products group for 1958-63.

³Data not tabulated at this level prior to the 1972 survey.

⁴Data not tabulated at this level prior to the 1977 survey.

⁵Included in the other electrical equipment group for 1958-63.

SOURCE: National Science Foundation.

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Table B-42. Total and company R&D funds per employee by size of company: 1963 and 1967-80

Size of company (based on number of employees)	1963	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980
	Total R&D funds per employee														
Total.....	\$1,110	\$1,180	\$1,210	\$1,220	\$1,250	\$1,300	\$1,386	\$1,468	\$1,624	\$1,728	\$1,912	\$2,077	\$2,240	\$2,453	\$2,801
Less than 1,000.....	520	660	(¹)	(¹)	840	920	892	863	1,010	1,043	1,139	1,051	1,123	1,254	1,392
1,000 to 4,999.....	580	570	(¹)	(¹)	770	690	757	758	791	786	852	963	1,066	1,321	1,416
5,000 to 9,999.....	1,310	560	690	670	720	750	736	790	879	930	1,138	1,261	1,143	1,102	1,326
10,000 to 24,999.....		1,470	1,450	1,450	1,470	1,540	781	773	837	920	1,041	1,215	1,407	1,549	1,732
25,000 or more.....	1,962 2,127 2,421 2,644 2,829 2,994 3,045 3,614 4,175														
	Company R&D funds per employee														
Total.....	\$470	\$580	\$610	\$660	\$710	\$760	\$818	\$905	\$1,040	\$1,112	\$1,233	\$1,347	\$1,487	\$1,650	\$1,912
Less than 1,000.....	360	420	(¹)	(¹)	510	590	579	580	657	810	893	879	933	956	1,111
1,000 to 4,999.....	340	370	(¹)	(¹)	470	480	525	540	572	642	699	790	841	910	1,020
5,000 to 9,999.....	520	420	470	500	580	620	609	663	729	749	921	1,004	989	997	1,088
10,000 to 24,999.....		660	690	740	800	850	557	598	688	791	842	927	1,077	1,237	1,452
25,000 or more.....	1,059 1,204 1,432 1,519 1,651 1,781 1,873 2,271 2,653														

Note: Averages were derived by dividing total and company R&D funds for a calendar year by employment figures for March of that year.

¹Not separately available but included in total.

SOURCE: National Science Foundation.

section C

reproduction of survey instruments

	<i>page</i>
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Bureau of the Census covering letter for Form RD-1	43
Instructions	44
Form RD-1	48
Form MA-121	50



OFFICE OF THE
DIRECTOR

January 21, 1981

Dear Respondent:

The National Science Foundation requests your company's participation in the 1980 Survey of Industrial Research and Development.

The information provided by this survey is needed to evaluate this country's scientific research effort and to formulate effective public policies designed to promote and strengthen industry's role in scientific and technological innovation. In addition, we have found that individual companies use the aggregate data from this questionnaire in assessing and planning their own research and development programs.

The data obtained from the survey are collected and compiled by the U.S. Bureau of the Census for the National Science Foundation. Inquiries regarding the survey should be directed to the U.S. Department of Commerce, Bureau of the Census, Washington, D.C. 20233.

Your participation in this survey is greatly appreciated. The Foundation will be pleased to send your firm a copy of the published report. Requests should be sent to Dr. Charles E. Falk, Director, Division of Science Resources Studies, Room L-602, National Science Foundation, Washington, D.C. 20550.

Sincerely yours,

A handwritten signature in cursive script that reads "Donald N. Langenberg".
Donald N. Langenberg
Deputy Director

Enclosure

BEST DOCUMENT AVAILABLE



UNITED STATES DEPARTMENT OF COMMERCE
Bureau of the Census
Washington, D.C. 20233

OFFICE OF THE DIRECTOR

FROM THE ACTING DIRECTOR
BUREAU OF THE CENSUS

Enclosed are your report form and file copy for the "Survey of Industrial Research and Development During 1980" (RD-1). Also enclosed are an instruction manual to assist you in completing the report and a letter from the survey sponsor, the National Science Foundation, which describes the uses and importance of the survey results.

For 1980, the survey form has been modified from the 1979 version and is comparable to the one used in 1978. You may recall that for the past several years we have been alternating between a "long" and a "short" form to minimize respondent reporting burden. The "short" version is being used for 1980.

The instruction manual provides guidelines for reporting. However, it is recognized that book records for particular items may not be maintained. In such cases, carefully prepared estimates are acceptable.

This report is authorized by law (title 13, U.S. Code, sections 131, 182, 224, and 225). Items 2A and 2B, and columns 2 and 4 of item 5C, are part of the basic statistical program of the Bureau of the Census, and reporting of these items is mandatory. Response to the remainder of the inquiries is voluntary; however, your cooperation is needed to make the results of the survey comprehensive and accurate. Your report to the Census Bureau is confidential by law (title 13, U.S. Code, section 9). It may be seen only by sworn Census employees and may be used only for statistical purposes. The law also provides that copies retained in your files are immune from legal process.

Requests for additional forms may be made by calling (812) 288-3331. Questions concerning the survey, or requests for copies of the survey results, should be directed to Special Projects Branch, Industry Division, Bureau of the Census, Washington, D.C. 20233 or phone (301) 763-5598.

We appreciate your past cooperation in this important survey and look forward to your continued participation.

Sincerely,

DANIEL B. LEVINE

Enclosures

LEST DOCUMENT AVAILABLE

INSTRUCTIONS FOR SURVEY OF INDUSTRIAL RESEARCH AND DEVELOPMENT DURING 1980

Outline of instructions	
GENERAL	Page
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Preposted figures	1
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GENERAL

Information About Reporting: Additional Forms — Reporting on this form may require that companies resort to the use of estimates in answering some of the questions. We are satisfied, however, that the comparability of data among companies with research and development programs is sufficient to develop meaningful totals and measures of changes from year to year.

If you require additional copies of the form, write to the Bureau of the Census, 1201 East Tenth Street, Jeffersonville, Indiana 47132. If you have any questions regarding reporting on this form, write to the Bureau of the Census, ATTN: Industry Division, Washington, D.C. 20233, or call Area Code (301) 763-5598.

Companies Reporting in Survey for the First Time — Companies not reporting in 1979 survey should fill in the figures for both years. If the company had no

expenditures for research and development, complete only "Item 2." Enter "No R&D" in the space for remarks on page 2 of the form, sign and return the form.

Figures for Earlier Years are Preposted on the Form — If your company reported on form RD-1 for 1979, certain figures from that form have been copied to the present form. Please describe in the "Remarks" section (page 2 of the form) the reasons for any substantial increases or decreases in the 1980 figures entered on this form when compared to corresponding 1979 figures. Examples of such reasons are new government contracts, acquisitions, and disposals, revised accounting method, etc. If you acquired or disposed of a unit performing an important amount of research and development during the 2-year period, please identify the unit in remarks, and give the total amount of research and development accounted for by such unit.

GENERAL – Continued

Revision of Earlier Year Figures – The 1979 figures should be revised if necessary to assure comparability with 1980 data. Please explain in remarks, any significant change in the 1979 figures. If your company did not report for 1979 or no entries have been entered in the 1979 column, fill in the figures for both years.

Report for Your Entire Company – Research and development activities for your entire domestic company should be reported, including all subsidiaries and divisions of the company. If you desire to have subsidiaries report separately, please write to the Bureau of the Census and list your subsidiaries.

Period Covered by Report – The figures reported should cover the calendar year if at all possible. However, fiscal year data are acceptable for all items except employment, provided your fiscal year ends between September and March. Please report employment figures (items 2B and 4) for the period identified in each of the items mentioned.

Section I – GENERAL COMPANY DATA

Item 2 – Sales and Employment for Company – In item 2A, report the net sales and receipts of this company and its subsidiaries to customers outside the company. (Exclude domestic intra-company transfers and sales by foreign subsidiaries; however, include transfers to such foreign subsidiaries; and export sales to foreign companies.) The reported figures should represent value f.o.b. plant after discounts and allowances and should not include freight charges; excise taxes should be excluded. In item 2B report the number of persons employed at the company in all activities in the 50 States and the District of Columbia during the pay period which includes the 12th of March 1979 and 1980. This figure would be the same as that shown by the company in item 3 of Treasury Form 941, if the company filed one form 941 for the entire company.

DEFINITION OF RESEARCH AND DEVELOPMENT

Research and development includes basic and applied research in the sciences and in engineering, and design and development of prototype products and processes. For the purposes of this questionnaire, research and development includes activities carried on by persons trained, either formally or by experience, in the physical sciences including related engineering, and the biological sciences including medicine but excluding psychology, if the purpose of such activity is to do one or more of the following things:

1. Pursue a planned search for new knowledge, whether or not the search has reference to a specific application.
2. Apply existing knowledge to problems involved in the creation of a new product or process, including work required to evaluate possible uses.

3. Apply existing knowledge to problems involved in the improvement of a present product or process.

Research and development includes the activities described above whether assigned to separate research and development organizational units of the company or carried on by company laboratories and technical groups not part of a research and development organization. We recognize that the reporting activities of such latter groups will require the use of estimates for some of the questions.

Activities to be Excluded From Research and Development – Research and development for purposes of this survey does not include quality control, routine product testing, market research, sales promotion, sales service, research in the social sciences or psychology, or other nontechnological activities or technical services.

More specifically, exclude from research and development such nontechnological activities as market research, including statistical surveys of product acceptance, estimates of market size, and studies of channels of distribution; and market development, including the sale of either old or new products to obtain acceptance of them in new outlets; economic research and other research in the social sciences; and legal work in connection with patent applications and litigation, and the sale or licensing of patents.

Also exclude from research and development such technical services as: quality and quantity control tests and analyses, troubleshooting in connection with breakdowns in full-scale production, including related analytical work; technical plant sanitation control; work required for minor adaptations of a specific product to meet the requirements of a specific customer, including installation and servicing in a customer's plant; engineering and other technical service furnished in accordance with agreements to licensees outside the company; aid furnished by the research and development organization to manufacturing divisions to enable them to operate in accordance with previously determined formulas, standard practice instructions, or finished product specifications; aid furnished to develop advertising programs and to promote or demonstrate new products or processes, including the cost of material furnished for trial or demonstration; assistance in preparation of speeches and publications for persons not engaged in research and development, and experimental work performed at the request of the patent division to provide information needed during the prosecution of a patent litigation.

Section II – RESEARCH AND DEVELOPMENT PERFORMED WITHIN THE COMPANY, IN THE UNITED STATES

Item 4 – Research and Development Scientists and Engineers – Scientists and engineers for this survey are defined as all persons engaged in scientific or engineering work at a level which requires a knowledge of physical or life sciences or engineering or mathematics, equivalent at

least to that acquired through completion of a four-year college course with a major in these fields, regardless of whether they held a college degree in the field.

As in the past, the figure on R&D scientists and engineers will be obtained primarily from two sources:

1. Records on the number of scientists and engineers assigned to research and development. This source is satisfactory so long as the scientists and engineers of the unit are assigned to research and development on a full-time basis (i.e., no more than 5 percent of their time is spent on nonresearch and development). For example, for company laboratories performing only research and development, report the number of scientists and engineers on the rolls in January. For other units, use source 2.

2. Figures on the proportion of total work time of scientists and engineers that is devoted to research and development. For example, if the engineering department of a manufacturing plant had 60 scientists and engineers in January 1980 and one-fourth of the scientists' and engineers' time during that month was charged to research and development projects, the figure for the number of research and development scientists and engineers included for that unit would be 15.

Cost or Receipts for Research and Development Performed Within the Company by Source of Funds — Include all costs incurred to support research and development, exclusive of capital expenditures, but including depreciation and overhead. If you perform research and development for others on contract, include the total charged for the work performed, including profit.

The relevant costs usually include but are not limited to the elements listed below:

1. Wages, salaries, and related costs. Material and supplies consumed (or purchased, if consumption figures are not available); utilities, such as telephone, telegraph, electricity, water, gas, and fuel; books and periodicals; travel and entertainment costs and professional dues.

2. Property taxes and other taxes (except income taxes) incurred on account of the research and development organization or on the facilities which the research and development organization uses. Insurance expense. Maintenance and repair, including the maintenance of buildings and grounds, depreciation on buildings, equipment, and vehicles; or rentals, if any facilities are leased.

3. Company overhead. Estimate a fair share of the cost of any functions which support research and development activities. The basis and method of estimating overhead costs will depend upon company practice. The important point is to be sure that all companies include an allowance for overhead. Items normally covered in overhead include the following:

Personnel, including personnel, medical and safety departments, and employee or industrial relations department; accounting control and fiscal (Treasurer's office); procurement and inventory, including purchasing, receiving, inspection, storage, transportation, control, and issue of materials and supplies; other services, including legal, public relations, shopwork, analytical work, plant protection, rearrangement of facilities, drafting, printing, duplicating, transportation of material and personnel, maintenance of motor vehicles, messenger service, stenographic service, and photography; salaries and related costs of research executives not on the payroll of the research and development organization.

Do not net your research and development expenditures by the amount of royalties received from either non-company organizations or company units; or the credits received for research and development work charged or "sold" to other departments or divisions of reporting company or to outside organizations.

Types of Expense to be Excluded From Research and Development Costs — Exclude from the cost of research and development performed within the company the cost of research and development carried on for the company by noncompany research and development organizations of any kind; or fellowships, grants, and gifts to promote research and development or the study of the sciences and engineering. That part of company-held research and development contracts subcontracted to research and development organizations outside reporting company. All work that was done for your laboratories and other technical units by noncompany organizations which are not research and development organizations (for example, model construction by a noncompany model shop) is to be considered as a purchase of equipment, material, or supplies for the company research organization rather than as subcontracted research and development.

Also exclude capital expenditures, royalties paid, patent expense, income taxes, or interest. Income from sale of products manufactured in the research and development organization if these were sold to bona fide customers.

Item 5 — Research and Development Performed Within the Company by Source of Funds

This item provides separate columns for reporting in 1980 the costs of research and development in Federal contracts and subcontracts, and Company and Other research and development. Definitions of "Federal," and of "Company and Other" are provided below.

Source of Funds — A separate column in item 5 is provided for each of the following:

Item 5, Column 2 — Federal — Include the cost of work done on research and development contracts or subcontracts, and research and development portions of procurement contracts and subcontracts during the year.

Do not include here, or elsewhere in the report, research and development contracts and the portions of procurement contracts that you subcontracted to other research and development organizations. To do so would cause duplication in the statistical totals derived from these reports.

Item 5, Column 3 — Company and Other — Include the cost of all company-sponsored research and development performed within the company. Research and development is performed by a few manufacturing companies for others than the Federal Government. Such research and development should be included in this column.

In item 5C, report the expected or estimated cost of company-sponsored research and development that will be performed within the company during 1981.

Item 6 — Research and Development by Functional Category

Energy Research and Development — Include all R&D spending whose purpose is to increase energy resources or capabilities, including the development of energy equipment. Some R&D spending is for joint or multiple purposes. In these instances, estimate and report the portion of cost incurred due to the energy purpose. Energy R&D can include costs of R&D projects (both product and process) on exploration, extraction, transportation, processing, storage, generation (including conversion), distribution, conservation, etc., of present, new, or improved forms of energy. Record energy R&D spending according to type of energy.

"All other energy" includes areas such as geothermal, solar, conservation and utilization, wind, waste, hydroelectric, etc. Also include in this category, (C), the development of energy equipment which cannot be readily classified in A and B. If the energy source is waste or any other area with pollution abatement aspects, consider carefully whether one of the purposes of the project is pollution abatement.

In a limited number of cases, the separation of joint (multiple) costs which is encouraged in the preceding paragraph may not be feasible. In this circumstance, include total project cost if the primary purpose of a project is energy R&D, do not include any of project cost if the primary purpose of the project is other than energy R&D.

Pollution Abatement Research and Development — Pollution abatement R&D spending for the purpose of reducing or eliminating the emission of pollutants. As used here, abatement includes prevention, treatment, or recycling; pollution refers to the emission of pollutants to

the outside of a firm's (or household's) property or activities. Do not include R&D spending to contribute to environmental aesthetics, to increase equipment durability in corrosive environments, to conserve energy (include as energy R&D) and natural resources, or to increase employee comfort, safety, and health.

There can be two types of pollution abatement R&D spending. In some cases, the only purpose of the R&D spending is pollution abatement. Examples are spending on projects to improve or design alternatives to electrostatic precipitators, wet scrubber systems, waste treatment systems, effluent monitoring devices, etc. In such cases, include the total expenditures on the R&D project. In other cases, pollution abatement is one of several purposes. Examples are spending on projects to improve production processes or products and simultaneously reduce the emission of pollutants. Pollution abatement purposes could also be combined with other types of environmental control purposes such as energy conservation or employee safety and health. In all these instances, estimate and report only the portion of cost incurred due to the pollution abatement purpose.

In a limited number of cases, the separation of joint (multiple) costs which is encouraged in the preceding paragraph may not be feasible. In this circumstance, do not include any of project cost unless the primary purpose of the project is pollution abatement. When the primary purpose is pollution abatement, include the total project cost in your answer.

Do not include any of project cost as being for pollution abatement if expected pollution abatement benefits are incidental. Incidental benefits are those obtained at no extra cost.

Section III — RESEARCH AND DEVELOPMENT PERFORMED OUTSIDE THE COMPANY — (R&D not included in item 5)

Item 7 — Total Company Funds Spent for Research and Development Activities Performed by Foreign Affiliates Outside the United States — Report the amount of research and development financed by the U.S. parent or its foreign affiliates performed in R&D laboratories, branch plants, divisions, and subsidiaries located outside the United States.

This item excludes R&D activities performed in foreign affiliates financed by foreign governments or other outside organizations.

NOTE: Foreign affiliates are those outside the 50 States or the District of Columbia.

FORM RD-1 (10-17-80) U.S. DEPARTMENT OF COMMERCE BUREAU OF THE CENSUS COLLECTING AND COMPILING AGENT FOR THE NATIONAL SCIENCE FOUNDATION SURVEY OF INDUSTRIAL RESEARCH AND DEVELOPMENT DURING 1980	NOTICE - Your report to the Census Bureau is confidential by law (title 13, U.S. Code). It may be seen only by sworn Census employees and may be used only for statistical purposes. The law also provides that copies retained in your files are immune from legal process. <table style="width: 100%;"> <tr> <td style="width: 80%;"> Item 1 - NAME AND ADDRESS OF COMPANY - Please correct any error in name and address including ZIP code </td> <td style="width: 10%; text-align: center;">Group</td> <td style="width: 10%; text-align: center;">Survey</td> </tr> <tr> <td></td> <td style="text-align: center;">4</td> <td style="text-align: center;">4001</td> </tr> </table>	Item 1 - NAME AND ADDRESS OF COMPANY - Please correct any error in name and address including ZIP code	Group	Survey		4	4001														
Item 1 - NAME AND ADDRESS OF COMPANY - Please correct any error in name and address including ZIP code	Group	Survey																			
	4	4001																			
RETURN TO Bureau of the Census 1201 East Tenth Street Jeffersonville, Indiana 47132																					
Name of person who supplied 1979 data																					
NOTE: Data supplied in items 2A and 2B and in item 5A, columns 2 and 4, for 1980 on this form, will satisfy the mandatory reporting requirement of Census Form MA-121 (title 13, U.S. Code). Although you are not required to complete the other items, your cooperation on these voluntary items is needed to make the results of this survey comprehensive, accurate, and timely.																					
PLEASE RETURN THIS COPY																					
CENSUS USE ONLY	<table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 16.6%; border: 1px solid black; text-align: center;">1</td> <td style="width: 16.6%; border: 1px solid black; text-align: center;">2</td> <td style="width: 16.6%; border: 1px solid black; text-align: center;">3</td> <td style="width: 16.6%; border: 1px solid black; text-align: center;">4</td> <td style="width: 16.6%; border: 1px solid black; text-align: center;">5</td> <td style="width: 16.6%; border: 1px solid black; text-align: center;">6</td> </tr> </table>	1	2	3	4	5	6														
1	2	3	4	5	6																
GENERAL INSTRUCTIONS																					
• Please complete and return this form in the envelope provided within 60 days. Retain the file copy for your records. This report should cover your entire company, including all subsidiaries and affiliates, unless otherwise designated. • Enter "None" where appropriate rather than leaving a blank space. • Reasonably accurate estimates are acceptable. • Be sure 1979 and 1980 figures are comparable.																					
PLEASE READ ENCLOSED INSTRUCTIONS BEFORE COMPLETING THIS FORM																					
Section I - GENERAL COMPANY DATA																					
Item 2 - DOMESTIC SALES, RECEIPTS, AND EMPLOYMENT FOR COMPANY																					
	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 30%;">CT1</td> <td style="width: 35%; text-align: center;">1979</td> <td style="width: 35%; text-align: center;">1980</td> </tr> <tr> <td></td> <td style="text-align: center;">1</td> <td style="text-align: center;">2</td> </tr> </table>	CT1	1979	1980		1	2														
CT1	1979	1980																			
	1	2																			
A. Domestic net sales and receipts of this company (<i>Thousands of dollars</i>)	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 30%; text-align: center;">2001</td> <td style="width: 35%; text-align: center;">\$</td> <td style="width: 35%; text-align: center;">\$</td> </tr> </table>	2001	\$	\$																	
2001	\$	\$																			
B. Total domestic company employment in all activities during the pay period which includes the 12th of March 1979 and 1980.	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 30%; text-align: center;">2002</td> <td style="width: 35%;"></td> <td style="width: 35%;"></td> </tr> </table>	2002																			
2002																					
Item 3 - RESEARCH AND DEVELOPMENT EXPENDITURES Are research and development expenditures for entire domestic company, including subsidiaries and affiliates, reported on this form? ☐ Yes ☐ No - Please explain in remarks or on transmittal letter																					
Section II - RESEARCH AND DEVELOPMENT PERFORMED WITHIN THE COMPANY IN THE UNITED STATES <i>(Exclude R&D financed by the company but performed by others)</i>																					
Item 4 - NUMBER OF RESEARCH AND DEVELOPMENT SCIENTISTS AND ENGINEERS <i>(See instruction Manual, page 3)</i>																					
	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 30%;">CT2</td> <td style="width: 35%; text-align: center;">January 1980</td> <td style="width: 35%; text-align: center;">January 1981</td> </tr> <tr> <td></td> <td style="text-align: center;">1</td> <td style="text-align: center;">2</td> </tr> </table>	CT2	January 1980	January 1981		1	2														
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3099																					
Item 5 - COST OR RECEIPTS FOR RESEARCH AND DEVELOPMENT PERFORMED WITHIN THE COMPANY BY SOURCE OF FUNDS																					
	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 10%;"></td> <td colspan="4" style="text-align: center;"><i>Thousands of dollars</i></td> </tr> <tr> <td style="text-align: center;">CT2</td> <td style="width: 20%; text-align: center;">1979</td> <td colspan="3" style="text-align: center;">1980</td> </tr> <tr> <td></td> <td style="text-align: center;">1</td> <td style="width: 20%; text-align: center;">Federal funds</td> <td style="width: 20%; text-align: center;">Company and other funds except Federal</td> <td style="width: 20%; text-align: center;">TOTAL (Sum of columns 2 and 3)</td> </tr> <tr> <td></td> <td></td> <td style="text-align: center;">2</td> <td style="text-align: center;">3</td> <td style="text-align: center;">4</td> </tr> </table>		<i>Thousands of dollars</i>				CT2	1979	1980				1	Federal funds	Company and other funds except Federal	TOTAL (Sum of columns 2 and 3)			2	3	4
	<i>Thousands of dollars</i>																				
CT2	1979	1980																			
	1	Federal funds	Company and other funds except Federal	TOTAL (Sum of columns 2 and 3)																	
		2	3	4																	
A. TOTALS →	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 10%; text-align: center;">3599</td> <td style="width: 20%; text-align: center;">\$</td> <td style="width: 20%; text-align: center;">\$</td> <td style="width: 20%; text-align: center;">\$</td> <td style="width: 20%; text-align: center;">\$</td> </tr> </table>	3599	\$	\$	\$	\$															
3599	\$	\$	\$	\$																	
B. 1979 TOTALS →	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 10%;"></td> <td style="width: 20%; text-align: center;">\$</td> <td style="width: 20%; text-align: center;">\$</td> <td style="width: 20%; text-align: center;">\$</td> <td style="width: 20%; text-align: center;">\$</td> </tr> </table>		\$	\$	\$	\$															
	\$	\$	\$	\$																	
C. Company and other funds, except Federal, budgeted for the year 1981 →	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 10%;"></td> <td style="width: 20%; text-align: center;">CT1</td> <td style="width: 20%; text-align: center;">\$</td> <td style="width: 20%;"></td> <td style="width: 20%;"></td> </tr> <tr> <td></td> <td style="text-align: center;">3800</td> <td></td> <td></td> <td></td> </tr> </table>		CT1	\$				3800													
	CT1	\$																			
	3800																				

Please continue on reverse side

Section II – R&D PERFORMED WITHIN THE COMPANY IN THE UNITED STATES – Continued
(Exclude R&D financed by the company but performed by others.)

Item 6 – RESEARCH AND DEVELOPMENT BY FUNCTIONAL CATEGORY (Of the total reported in Item 5A, COSTS OR RECEIPTS FOR RESEARCH AND DEVELOPMENT, columns 2 and 4, report the following functional categories.)

ENERGY RESEARCH AND DEVELOPMENT Include the project cost or portion of project cost incurred for the purpose of increasing energy resources or capabilities. Include cost by type of energy. If "None," please mark (X) 80996	CT2	Thousands of dollars				
		1979		1980		1981
		1 Federal funds	2 Total funds	3 Federal funds	4 Total funds	5 Total projected costs
A. Total nuclear	8010	\$	\$	\$	\$	\$
B. Total fossil fuels	8020					
C. All other energy	8060					
D. TOTAL of A through C →	8099	\$	\$	\$	\$	\$

POLLUTION ABATEMENT RESEARCH AND DEVELOPMENT – Include the project cost or portion of the project cost incurred for the purpose of designing pollution abatement products or product characteristics or of designing pollution abatement features into processes. Include cost by form of pollution to be abated. If "None," please mark (X) 81996	CT2	Thousands of dollars				
		1979		1980		1981
		1 Federal funds	2 Total funds	3 Federal funds	4 Total funds	5 Total projected costs
TOTAL →	8199	\$	\$	\$	\$	\$

Section III – RESEARCH AND DEVELOPMENT PERFORMED OUTSIDE THE DOMESTIC COMPANY
(Not included in item 5 with company funds.)

Item 7 – TOTAL COMPANY FUNDS SPENT FOR RESEARCH AND DEVELOPMENT ACTIVITIES PERFORMED BY FOREIGN AFFILIATES OUTSIDE THE UNITED STATES If "None," please mark (X) 11603	CT2	Thousands of dollars		
		1979	1	1980
				2
	1160	\$		\$

Remarks – Attach additional sheet if necessary

Name of person to contact regarding this report	Address – Number and street, city, State, ZIP code	Telephone		
		Area code	Number	Extension

Period covered by this report	From – Month/day/year	To – Month/day/year
Calendar year	Fiscal year – Specify →	

CERTIFICATION – This report is substantially accurate and has been prepared in accordance with instructions

Name of company	Address – Number and street, city, State, ZIP code	
Signature of authorized official	Title	Date

FORM MA-121 (10-11-80) U.S. DEPARTMENT OF COMMERCE BUREAU OF THE CENSUS COMPANY SUMMARY OF RESEARCH AND DEVELOPMENT 1980	NOTICE - Response to this inquiry is required by law (title 13, U.S. Code, sections 131, 182, 224, and 225). By section 9 of the same law, your report to the Census Bureau is confidential. It may be seen only by sworn Census employees and may be used only for statistical purposes. The law also provides that copies retained in your files are immune from legal process. (Please correct any error in name and address including ZIP code)															
	<table style="display: inline-table; border-collapse: collapse;"> <tr> <td style="border: 1px solid black; padding: 2px;">Group</td> <td style="border: 1px solid black; padding: 2px;">Survey</td> </tr> <tr> <td style="border: 1px solid black; padding: 2px; text-align: center;">4</td> <td style="border: 1px solid black; padding: 2px; text-align: center;">9901</td> </tr> </table>	Group	Survey	4	9901											
Group	Survey															
4	9901															
RETURN TO Bureau of the Census ATTN: Industry Division Washington, D.C. 20233																
Please complete and return this form in the return envelope not later than 15 days after you receive it. Companies with no research and development expenditures should so state in the "Remarks" section, fill in items 1a and 1b, sign, and return the form.	PLEASE RETURN THIS COPY															
PLEASE READ INSTRUCTIONS ON REVERSE SIDE BEFORE COMPLETING YOUR REPORT																
Item 1 - SALES AND EMPLOYMENT FOR COMPANY																
a. Net sales and receipts of this company and its subsidiaries during 1980	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 10%; text-align: center;">C.T.1</td> <td style="width: 90%; text-align: right;">(Thousands of dollars)</td> </tr> <tr> <td style="text-align: center;">2001</td> <td style="text-align: right;">\$</td> </tr> </table>	C.T.1	(Thousands of dollars)	2001	\$											
C.T.1	(Thousands of dollars)															
2001	\$															
b. Number of employees in this company in all activities in the 50 States and the District of Columbia during the pay period which includes the 12th of March 1980	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 10%; text-align: center;">C.T.2</td> <td style="width: 90%; text-align: right;">(Number)</td> </tr> <tr> <td style="text-align: center;">2002</td> <td style="text-align: right;"></td> </tr> </table>	C.T.2	(Number)	2002												
C.T.2	(Number)															
2002																
Item 2 - COST OR RECEIPTS FOR RESEARCH AND DEVELOPMENT PERFORMED WITHIN THE COMPANY DURING 1980																
	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 10%;"></td> <td style="width: 10%; text-align: center;">C.T.2</td> <td colspan="3" style="text-align: center;">1980 (Thousands of dollars)</td> </tr> <tr> <td></td> <td></td> <td style="width: 15%; text-align: center;">1 Federal funds</td> <td style="width: 15%; text-align: center;">2 Company and other funds, except Federal</td> <td style="width: 15%; text-align: center;">3 TOTAL (Sum of columns 1 and 2)</td> </tr> <tr> <td style="text-align: center;">3599</td> <td style="text-align: center;">\$</td> <td style="text-align: center;">\$</td> <td style="text-align: center;">\$</td> <td style="text-align: center;">\$</td> </tr> </table>		C.T.2	1980 (Thousands of dollars)					1 Federal funds	2 Company and other funds, except Federal	3 TOTAL (Sum of columns 1 and 2)	3599	\$	\$	\$	\$
	C.T.2	1980 (Thousands of dollars)														
		1 Federal funds	2 Company and other funds, except Federal	3 TOTAL (Sum of columns 1 and 2)												
3599	\$	\$	\$	\$												
Remarks																
Name of person to contact regarding this report	Address (Number and street, city, State, ZIP code)															
Telephone (Area code, number, and extension)																
CERTIFICATION - This report is substantially accurate and has been prepared in accordance with instructions.																
Name of company	Address (Number and street, city, State, ZIP code)															
Signature of authorized official	Title															
Date																

► GENERAL INSTRUCTIONS

A report should be filed by each company receiving a copy of this form. If your company does not conduct research and development, so state in remarks, fill in items 1a and 1b, sign, and return the form. If you have questions regarding reporting problems on this form, please write to the Bureau of the Census, Industry Division, Washington, D.C. 20233.

Report for your entire company – Research and development activities for your entire domestic company should be reported.

Period covered by report – The cost figure reported should cover the calendar year if at all possible. However, fiscal year data are acceptable, provided your fiscal year ends between September and March.

► DEFINITION OF RESEARCH AND DEVELOPMENT

Research-development includes basic and applied research in the sciences (including medicine) and in engineering, and design and development of prototypes, products, and processes. It does not include quality control, routine product testing, market research, sales promotion, sales service, research in the social sciences or psychology, or other nontechnological activities or technical services.

► SPECIFIC INSTRUCTIONS BY ITEM

Item 1 – Sales and Employment for Company. In item 1a, report the net billings of this company and its subsidiaries to customers outside the company. (Exclude domestic intra-company transfers and sales by foreign subsidiaries. Include the transfers to such foreign subsidiaries, however.) In item 1b, report the number of persons employed by the company in all activities in the 50 States and the District of Columbia during the pay period which includes the 12th of March 1980.

This figure would be the same as that shown by the company in item 1 of Treasury Form 941, if the company filed one form 941 for the entire company.

Item 2 – Show all costs incurred within the company for wages and salaries, direct material costs, services and supporting costs, and an appropriate share of company overhead to conduct research and development activities.

Under Federal funds, include research and development in procurement as well as research and development contracts and research and development subcontracts. Exclude research and development subcontracted to others.

Remarks (Continued)

other science resources publications

Science Resources Studies Highlights

R&D Funds

Academic R&D Expenditures Increased 4% in Real Terms Between FY 1979 and FY 1980	82-300	-----
1980 Federal Obligations to Universities and Colleges Rose Slightly in Constant Dollars	82-301	-----

S/E Personnel

Universities Spent 6% of Separately Budgeted R&D Expenditures for Research Equipment in 1980	82-310	-----
Academic Science/Engineering Employment Increased Another 3% Between 1980 and 1981	82-312	-----
Labor Markets for New Science and Engineering Graduates in Private Industry	82-310	-----
Graduate Science/Engineering Enrollment Up 3% Between 1979 and 1980	82-306	-----
Growth in Scientific and Engineering Employment Slows Between 1978-80	82-303	-----
Engineering Colleges Report 10% of Faculty Positions Vacant in Fall 1980	81-322	-----
Trends in Science and Engineering Degrees, 1950 Through 1980	81-320	-----
Science and Engineering Faculty With Recent Doctorates Fell to One-Fifth of Total in 1980	81-318	-----
University S/E Faculty Spend One-Third of Professional Time in Research	81-317	-----
Tenure Practices in Universities and 4-Year Colleges Affect Faculty Turnover	81-300	-----

Detailed Statistical Tables

R&D Funds

Academic Science R&D Funds Fiscal Year 1980	82-300	-----
Research and Development in State and Local Governments Fiscal Year 1977	79-327	-----

S/E Personnel

U.S. Scientists and Engineers, 1980	82-314	-----
Characteristics of Recent Science/Engineering Graduates, 1980	82-313	-----
Academic Science/Scientists and Engineers, January 1981	82-305	-----
Academic Science/Graduate Enrollment and Support Fall 1980	81-330	-----

	NSF No.	Price
Scientists, Engineers, and Technicians in Private Industry, 1980	81-329	-----
Federal Scientific and Technical Personnel, 1976, 1977, and 1978	81-309	-----
Scientists and Engineers From Abroad, 1976-78	80-324	-----
Characteristics of Doctoral Scientists and Engineers in the United States, 1979	80-323	-----
Characteristics of Experienced Scientists and Engineers, 1978	79-322	-----

Reports

R&D Funds

1990 R&D Funding Projections	82-315	In press
Federal Support to Universities, Colleges, and Selected Nonprofit Institutions, Fiscal Year 1980	82-308	In press
Problems of Small, High-Technology Firms	81-302	-----

S/E Personnel

Science and Engineering Degrees: A Source Book, 1950-80	82-307	In press
Women and Minorities in Science and Engineering	82-302	\$7.00
Activities of Science and Engineering Faculty in Universities and 4-Year Colleges, 1978/79	81-323	In press
Young and Senior Science and Engineering Faculty, 1980	81-319	-----
Foreign Participation in U.S. Science and Engineering Higher Education and Labor Markets	81-316	\$4.50
Science and Engineering Employment, 1970-80	81-310	\$2.75
The Stock of Science and Engineering Master's Degree Holders in the United States	81-302	-----
Employment Attributes of Recent Science and Engineering Graduates	80-325	\$1.75
Occupational Mobility of Scientists and Engineers	80-317	\$1.75
Employment Patterns of Academic Scientists and Engineers, 1973-78	80-314	\$1.75

Composite

Science and Engineering Personnel: A National Overview	82-318	In press
Academic Science, 1972-81: R&D Funds, Scientists and Engineers, Graduate Enrollment and Support	81-326	-----

